INDIAN FARMING

ISSUED BY
THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH

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FAMINES AND FAMINE FODDERS

THE principal causes of famine in India are either too much or too little rain, resulting in floods or drought, more frequently the latter. Records of the occurrence of famines are available from 1708 B.C. Out of about 105 famines that devastated India since 1708 B.C., most were due to complete failure or insufficiency of the monsoon. According to these causes, India could roughly be divided into two main regions: *Region 1* comprising Sind, Rajputana, North-West Frontier Province and part of the Punjab, Madras and Bombay exposed to droughts and *Region 2* extending over Assam, Bengal, Bihar and Orissa exposed to floods. Both factors result in failure of the ordinary productiveness of the soil, and leave men and cattle destitute of food.

During the 19th and 20th centuries major famines occurred in 1861, 1877, 1899, 1918 and 1937-39. The last two famines are considered to be the most severe within living memory. The famine of 1918 was widespread, affecting almost all parts of the country, and that of 1939 affected the south-west Punjab, Sind, and a part of Bombay, Madras and Kashmir State. So acute were the privations caused by the 1939 famine, that a large number of persons subsisted on one poor quality meal; men worked for 1½ to 2 annas, women and children for 1 anna per day and some had to walk 4 to 10 miles daily to find work. Expectant mothers sometimes went without food for several days and some women were reported to have done away with their children. Epidemics contributed to increase the mortality. The scarcity of drinking water was such that for miles there was none available and it had to be transported over distances of 4 to 10 miles in leather bags on draught animals. Subsoil water level was about 80 to 100 feet. In a village in the Hissar district it was observed that the last remains of muddy water in a pond were shared by both the human and cattle population at the same time and guinea-worm infection was rife amongst the human population.

Under these dreadful conditions of human suffering the plight of livestock can be imagined. Insufficient rain for three successive years (1937-39) resulted in complete failure of fodder and grain crops, the pasture lands presented a barren appearance and the trees were lopped till they were little more than stumps. Apart from that, practically nothing was found growing except thorny or poisonous plants. Most of the best cattle, and incidentally some of the finest breeds are found in these areas, were sent to places where fodder was available, sold at ridiculously low prices, e.g. 8 annas to Rs. 2, or died of starvation. Most of the emaciated survivors ate almost anything which even resembled food; some were observed picking up waste paper and rags and, as was to be expected, classical symptoms of the well known deficiency diseases were commonly exhibited. According to the information supplied by the Marketing Officer, Sind, there were approximately 5,61,000 cattle before the famine in the three divisions of the Tharparkar district. By May 1940, when the famine was still raging, about 2,69,000 of these had died from starvation, 1,17,000 were exported and 10,000 sold. In the affected areas of Rohtak and Hissar district the decrease in the cattle population was estimated at 30 to 60 per cent, as compared with the census of 1935. Carcases of cattle were frequently found lying on the road side in the affected areas.

At the first rainfall the peasants had neither plough bullocks nor money to buy them and at many places, in the Hissar district, the men and their families pulled the ploughs themselves.

According to a recent estimate the total amounts of fodder and concentrates available under normal conditions are sufficient only for 55 per cent and 29 per cent respectively of the cattle population. Projected development will help to remove the shortage but the possibilities or rather the probability of future famine conditions must be faced and in an endeavour to find some way of mitigating their consequences the animal nutrition laboratories at the Imperial Veterinary Research Institute have explored the possibilities of hitherto unused sources of fodder and concentrates. Wastes like *munj*, groundnut husk, corn hearts, *kans*, rice husk, and molasses, etc., found round or near affected areas, and xerophytic shrubs and tree leaves, green and dry, usually found in arid and semi-arid areas have been examined as potential subsistence rations for livestock. Extensive investigations have been made on the possibility of feeding *munj* (*Saccharum munja*), *kans* (*Saccharum spontaneum*), *patera* (*Typha latifolia*), *kantiara* (*Carthamus oxycantha*) and groundnut husk as fodders, and mango-seed kernel and slaughter-house refuse as sources of protein.

After thorough chemical and toxicological analyses these wastes were processed, balanced and fed to animals for 3 to 12 months, to assess their nutritive value and see if they produced any bad effect on health.

Munj (*Saccharum munja*) grows over millions of acres of land in the drier regions of India, and except that young shoots may be broused and that part is used for thatching, most of it is disposed of by burning. Feeding experiments extending over a period of about a year indicate that when cut at the pre-blossom stage it can form a maintenance ration for cattle. One hundred pounds of green *munj* yield 56·1 lb. of total digestible nutrients and 34·4 lb. of starch equivalent; one acre will yield approximately 9,200 lb. and 5,640 lb. respectively. The dry plant also has been fed, essentially as a filler, after supplementing with a little oil-cake and molasses. *Kans* (*Saccharum spontaneum*), ordinarily considered to be a pest, grows over millions of acres of land and is extremely difficult to eradicate; considerable sums have in fact been spent in attempting to do so. Nevertheless, *kans* has been found to be a maintenance ration and equal in feeding value to green napier and guinea grass and to common straws like wheat straw. These observations necessitate a complete re-orientation of previous ideas as to the usefulness of *kans* and of *munj*. One hundred pounds of *kans* contain 63·5 lb. of T.D.N. and 40 lb. of S.E. and one acre will yield about 4,786 lb. of T.D.N. and 3,015 lb. of S.E. *Patera* (*Typha latifolia* Edgent) grows in river basins and swamps and is not ordinarily eaten by livestock except elephants. After supplementing with a little oil-cake it has been found suitable for cattle. One hundred pounds of *patera* contain 39·2 lb. of T.D.N. and 31·3 lb. of S.E.; one acre will yield about 1,735 lb. of T.D.N. and 1,382 lb. of S.E. *Carthamus oxycantha* is a native of arid tracts. The spinosed clumps constitute an objectionable feature of the grassy tracts. This plant is found growing abundantly in the hot months of May and June in wheat-harvested fields. In spite of its luxuriant growth, animals do not touch it. It is fairly rich in protein, and by simply rounding the thorns by beating, it has been fed in the dry condition successfully to animals after mixing with oat straw. In the early green stage, the plant is eaten by animals with great relish and, as far as its food value goes, it compares favourably with protein-rich fodders like lucerne and berseem.

Groundnut husk has been fed with advantage to animals after supplementing with a little oil-cake and molasses and has formed a satisfactory feed for animals.

Mango-seeds are at present not used. Chemical analyses of the kernel has shown it to contain 8·5 per cent of protein. It has been tried on cattle by replacing 50 per cent of the food protein. After an observation period of three months, adult Kumaonese bullocks gained on an average about 20 to 40 lb. in weight and developed a fine bloom. According to these observations, mango-seed kernel may become one of the important concentrates for livestock, comparing favourably with oat grain. This hitherto unutilized source of food makes available about 70 million pounds of total digestible protein and 760 million pounds of starch equivalent per year.

The foregoing are facts which may be read with surprise but, nevertheless, they are facts. It has not been possible to obtain accurate information as to the total available quantity of *munj*, *kans*, *patera*, or *Carthamus* but as they are assumed to infest most of the fallow lands, the food nutrients available from these sources in the light of the above investigations can obviously go some way to saving animals from starvation during famine and to meeting an appreciable portion of the quantitative livestock food shortage.

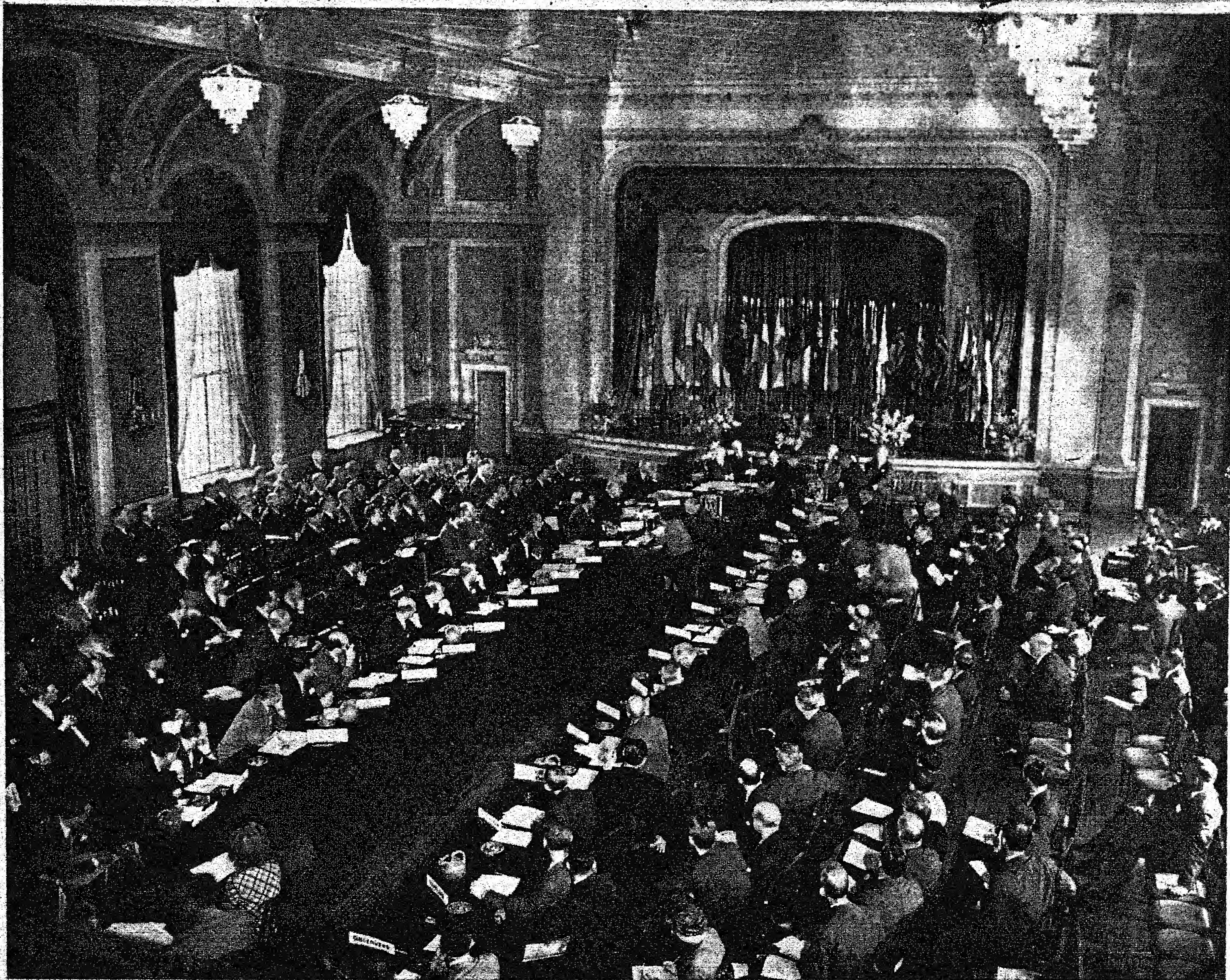


PLATE 1

The first Plenary meeting of the Food and Agriculture Organization Conference of the United Nations in the ball room of Chateau Frontenac, Quebec City

PLATE 2 Mr L. B. Pearson, Chairman of the Conference welcomes the Member for India, Sir Girja Shankar Bajpai

Original Articles

THE FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

M. S. Randhawa
Secretary, Imperial Council of Agricultural Research, New Delhi

THE Conference on the Food and Agriculture Organization of the United Nations, which met at Quebec City on October 16, and concluded its proceedings on November 1, 1945, marks an important mile-stone in the march of humanity towards world cooperation and progress. An organization was created at Quebec to deal with the basic industry of humanity and its problems. The Conference was held in Chateau Frontenac, the famous hotel which has already achieved historical importance on account of the two Churchill-Roosevelt meetings which took place in it during the progress of World War II. In this famous building which was once the Chateau of the French ruler of Quebec, were made plans which ultimately resulted in the victory of the Allies. Very fittingly, this hotel has seen the birth of an organization, the main purpose of which is to consolidate peace by fostering food production, by bringing scientific technique into the service of mankind and by serving the people in the war-devastated areas and other countries whose economy has suffered a serious jolt on account of the repercussions of the War.

The preliminary meeting

The preliminary meeting of the Conference was held on October 16. Mr. L. B. Pearson, the Canadian ambassador to the United States and Chairman of the Interim Commission on Food and Agriculture, presided. Representatives of 30 countries, viz. Australia, Belgium, Canada, China, Czechoslovakia, Denmark, Dominican Republic, Egypt, France, Greece, Guatemala, Haiti, Honduras, Iceland, India, Iraq, Liberia, Luxembourg, Mexico, Netherlands, New Zealand, Nicaragua, Norway, Panama, Peru, Phillipine Commonwealth, Union of South Africa, United Kingdom, U.S.A., and Venezuela, signed the constitution. Representatives of Brazil, Colombia, Cuba, Poland, Yugoslavia, Syria and Lebanon signed the constitution on a later date. The only important country, which did not sign the constitution is the Soviet Union as their Government felt that the organization forces of FAO required further study and they had to consult some of their constituent Republics, which are large producers of agricultural products and raw materials. However, the representatives of the Soviet Union took part in the proceedings of the Committees and panels of the Conference and attended as observers.

The Conference opened in the ball room of Chateau Frontenac. On the dias were arranged the flags of the United Nations. Mr. Ernest Bertrand, Post-Master General, Canada, welcomed the delegates from the different countries on behalf of the Government of Canada. The ball room was brilliantly illuminated and flashes occurred from time to time as the press photographers photographed the various events of the meeting. Sir Girja Shankar Bajpai, Member for India and the Chairman of the India Delegation, and the Leader of the Delegation from France, thanked the Government of Canada for their hospitality and complimented Mr. Pearson for the good work which he had done as Chairman of the Interim Commission.

Plenary meetings

At the seven plenary meetings the members from the various countries read statements detailing special features of the agricultural economics of their respective countries, their food situation and the type of organization they expected FAO to develop in tackling their special problems. At the eighth plenary meeting held on October 22, Sir John Boyd Orr, the eminent Scottish nutritionist, scholar and legislator, was appointed as the first Director General of FAO. Sir John renounced his nationality and became the first world citizen

on accepting the post of Director General. In his address, Sir John outlined the task of FAO and stated that the signatory nations had not only accepted responsibility to provide, as far as possible, food and health standards for all the people they govern, but they had also agreed to cooperate in a great World Food Scheme which will bring freedom from want of food to all men irrespective of race or colour. He also mentioned that the time has come when tanks are turned into tractors and the factories which manufactured explosives are converted to produce fertilizers and humanity enters an era of Peace and Plenty.

The delegates

Most of the delegates had arrived at Quebec by air. Some of them had come from distant countries and continents like China, India, Africa and Europe. Journeys which used to take 30 to 40 days were completed in 3 or 4 days, and there was a practical realization that we are living in a different world—a world which has shrunk to one-tenth of its size, and it was no longer possible for nations to live in isolation. The proceedings of the Conference were conducted in a spirit of good will and harmony and an atmosphere of cordial cooperation prevailed throughout the deliberations of the Conference. The Conference had met at the conclusion of a bloody war, which had caused unparalleled destruction of human lives and property and had left a legacy of devastated areas, with ruined agriculture and industry, all over the surface of the globe. It was also realized that this long protracted conflict had terminated suddenly by the use of a new weapon and a new source of power, viz. atomic fission, which, unless controlled and used in the service of mankind might destroy humanity itself. The challenge which the new scientific discovery had thrown to the social and economic structure of the present-day world was too serious to be ignored. The alternative before humanity is to plan, cooperate or perish. It was also realized that unemployment, poverty and hunger are the basic causes of war, and as Mr. Wilson, member for New Zealand, put it 'Neither political alliances nor military commitments nor atomic bombs, nor regional organizations can guarantee security for life in a world that is afflicted with poverty, pestilence and famine'. Nearly all the delegates felt that another slump in the prices of agricultural commodities, similar to that which paralysed agriculture and ultimately industry in 1930, must be prevented and the producer of agricultural commodities must be guaranteed a fair and equitable price. The general trend seemed to be in favour of Economy of Plenty and full employment policy with scientific technique harnessed to the needs of mankind rather than the continuation of the Economy of Scarcity and Starvation under which farmers are paid subsidies not to produce more food, and the so-called food surpluses are destroyed.

The delegates from India placed the particular needs of their country in a forceful manner before the Conference. While we do not expect FAO to work miracles for us, the main task of liquidating the vast and ancient rural slum extending over our four lakhs of villages is entirely our own; we are in need of technical assistance in the form of expert advice and machinery from countries which are in a position to give us this help. We realize that the problem of mass poverty in India can be solved in India alone by harnessing the entire resources of the country and by making their fullest possible use through the application of modern scientific technique. But in our transitional stage, it is necessary that we should be able to make use of the accumulated experience of the more advanced countries.

A World Food Plan

The main object of the Conference was to create a Food and Agriculture Organization of the United Nations. In this task, the Conference has succeeded. Through the compiling of scientific knowledge and technique, by assembling and analysing basic information and fostering cooperative action, FAO can play an important role in ushering in the Age of Plenty. One objective of FAO is to undertake a complete world survey of production, consumption and international trade in the major agricultural products as contrasted with world needs for improved nutrition in view of the consumption goals set up by Governments of different countries so that information about agricultural surpluses is made available and international trade in agricultural produce is regulated. FAO will also undertake comparative studies of the world food needs, methods and costs and the measures which have been adopted to achieve vital food distribution and assembling and analysing periodical reports on price support and income stabilization policies. Special arrangements will be made for diverting surpluses on special terms to low income areas which are suffering from nutritional deficiencies.

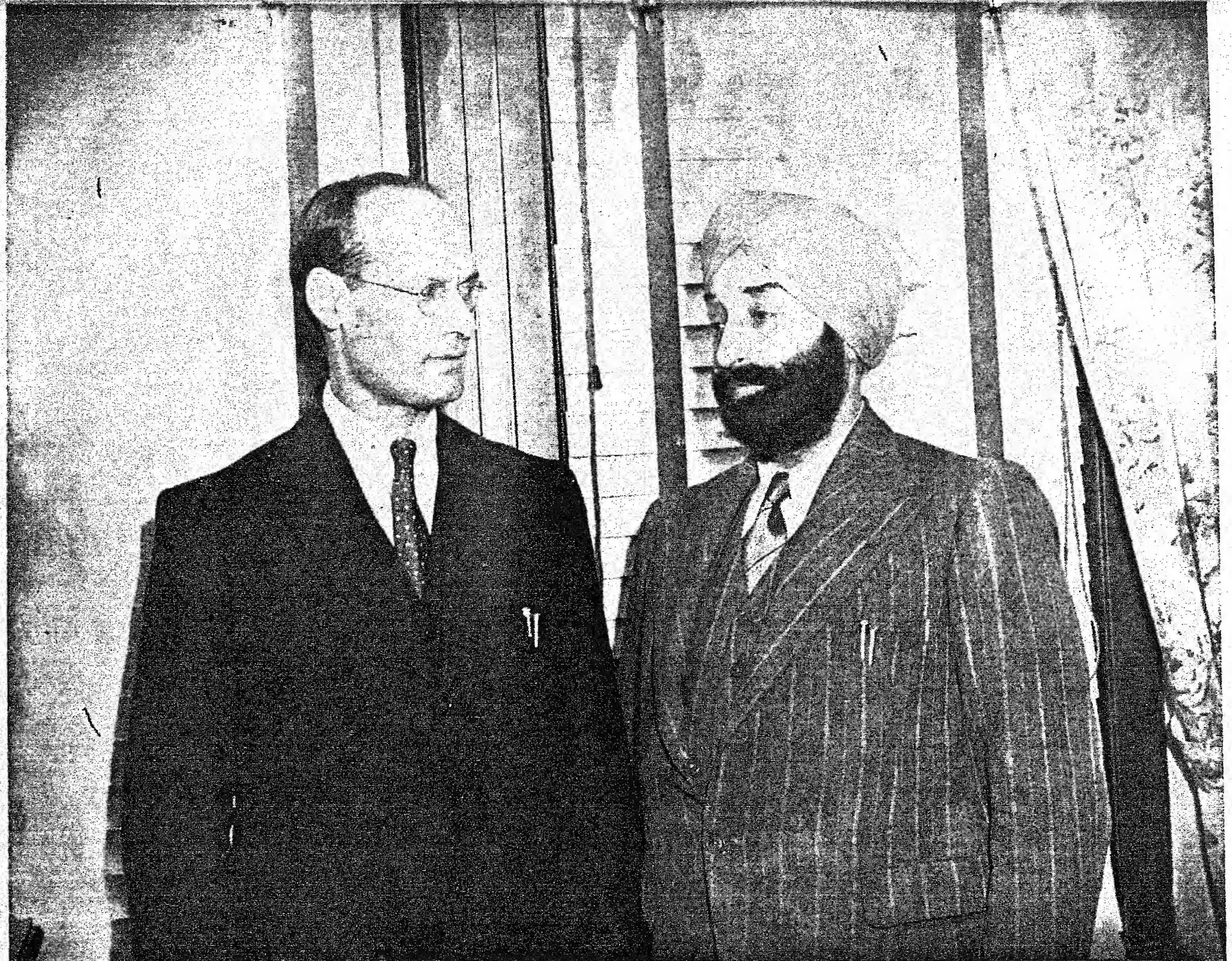


PLATE 3

The author with S.B. Ujjal Singh, delegate from the Punjab

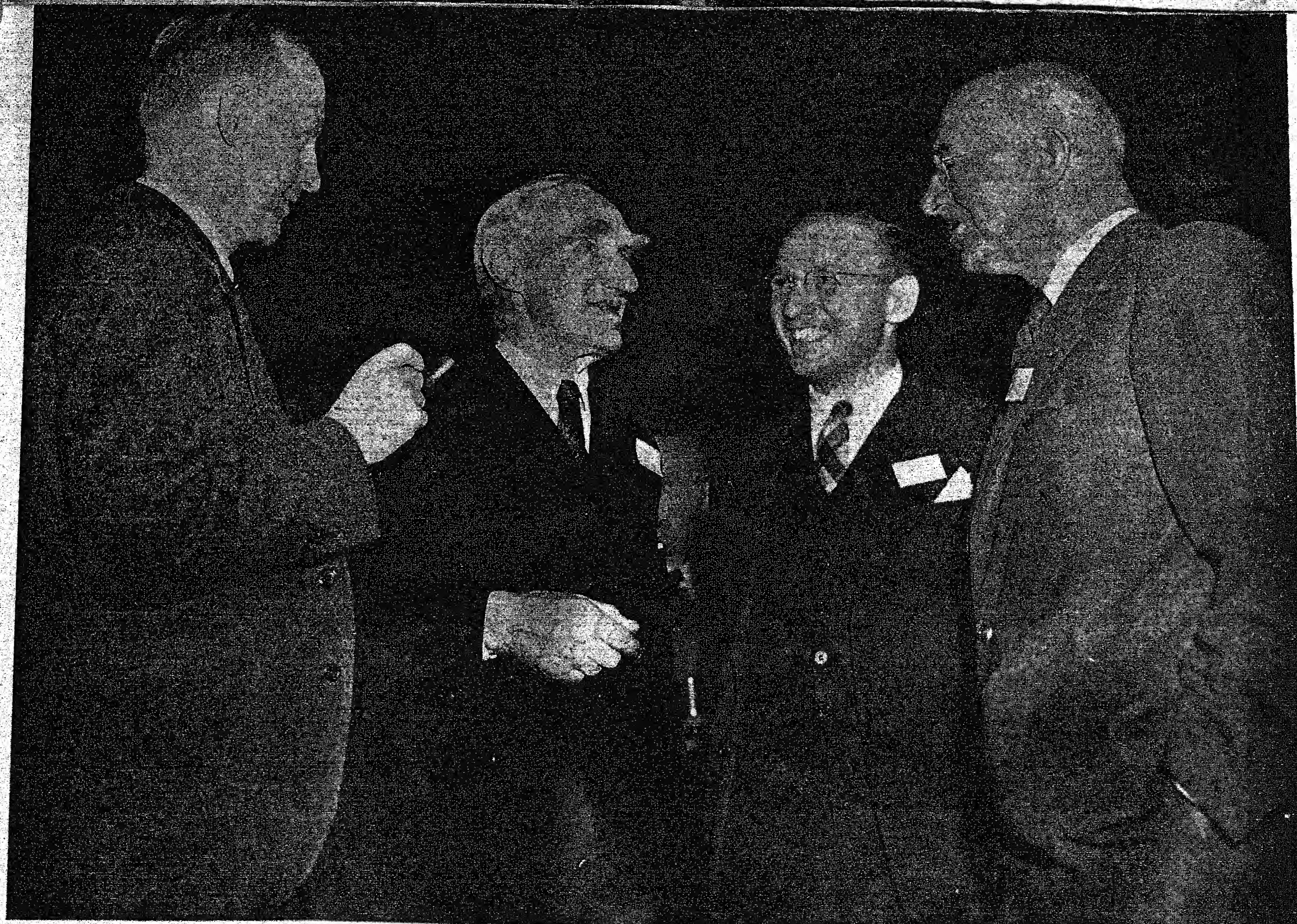
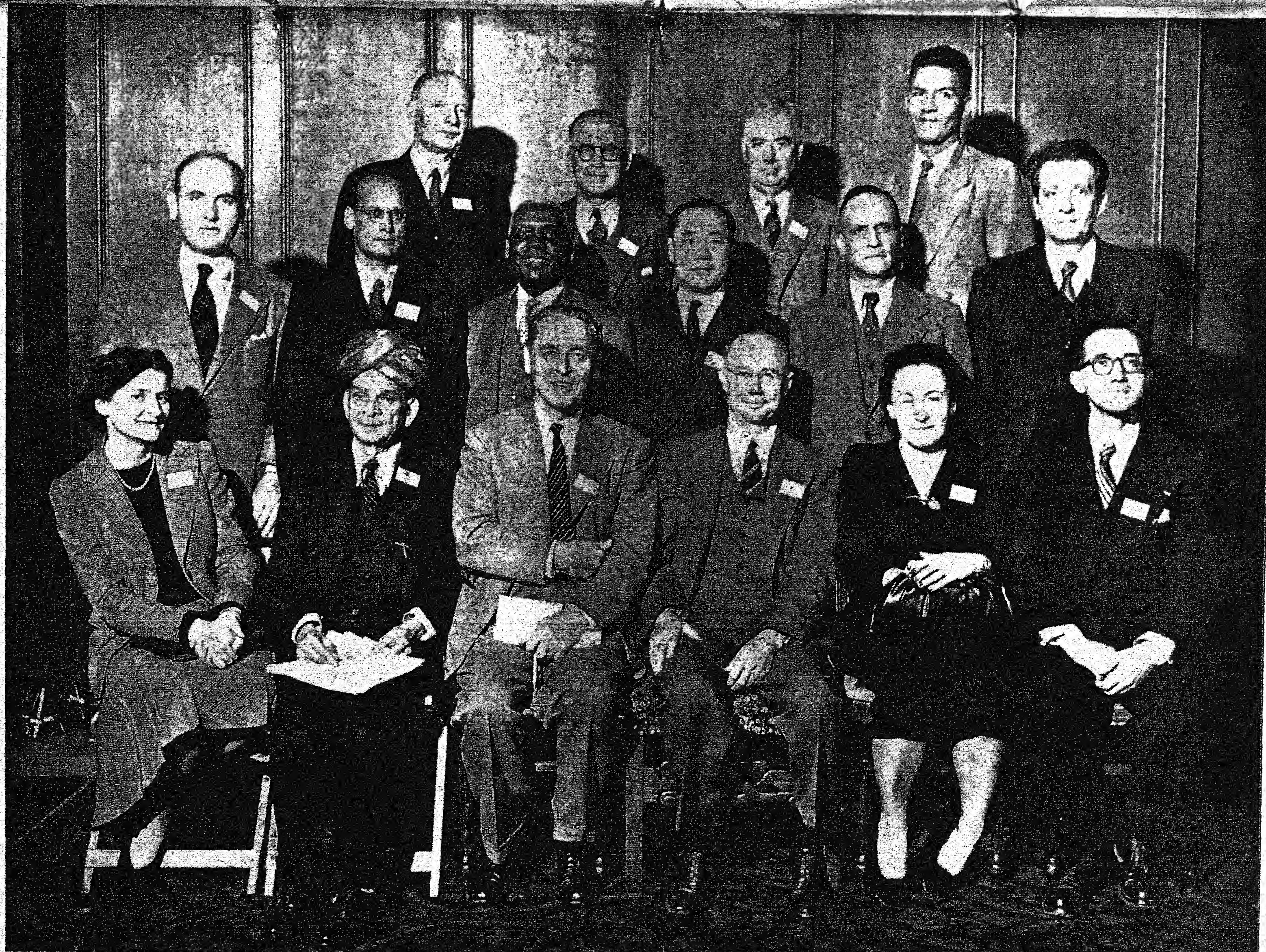


PLATE 4

Sir John Boyd Orr, Director General of FAO is second from left



MEMBERS OF THE EDUCATION AND EXTENSION PANEL OF THE AGRICULTURE COMMITTEE

First Row (sitting) L to R :—1. L. Beattie (Canada), 2. Sir T. Vijayaraghavacharya, 3. Dr Spencer Hatch, 4. Dr Deering (U.S.A.), Chairman, Extension Panel, 5. Koretskaya (U.S.S.R.), 6. P. Vidand (France)

Middle Row (standing) L to R :—1. (Greece), 2. M. S. Randhawa (India), 3. Price (Liberia), 4. S. Hsieh (China), 5. Galiordo (Mexico), 6. Belleza (Brazil)

Back Row (standing) L to R :—1. Jacobsen (Denmark), 2. du Toit (S. Africa), 3. R. L. Wilson (U.S.A.), 4. U. E. Baker (Haiti)

PLATE 5

A world census for 1950 is proposed with the object of collecting data on the world food and agriculture conditions and thus preparing a World Food Plan.

FAO will not be a centralized body like the League of Nations, which had a tenuous link with member countries through publicity officers only. FAO will have regional offices through whose agency it will maintain an intimate contact with the peoples and problems of different countries. It is likely that India too will have a regional office. It is a standing grievance of many countries that the staff of the League of Nations was overwhelmingly European in origin. It has been decided that the personnel of FAO will be truly international in character and representative of the various geographical regions. Vacancies will be widely advertised and selection will be made by the Director General on a competitive basis. It has also been decided that the seat of FAO should be located in the same place as the headquarters of the United Nations Organization. As headquarters of the United Nations Organization has not been determined, the seat of FAO will be provisionally in Washington.

A Dynamic Organization

It will be seen that FAO will not be merely a fact-collecting agency like the International Institute of Agriculture at Rome, but a dynamic organization with a bold and constructive programme. The results of scientific research will be compiled and made available to member countries through a bibliographic service, whose function will be that of assembling, compiling and abstracting scientific and technical information. Through the agency of FAO, plant and animal material for breeding will be made available to member countries. This will be particularly valuable to plant and animal breeders in India. Organization plays as important a role as ideas in scientific discovery, and hence the benefits which agricultural research institutes in India can derive cannot be over-estimated. The gulf between scientific discovery and its application in India is to be bridged. Extension work in India is still in a rudimentary condition. FAO would assemble, summarize and distribute to member Governments pamphlets, charts, posters, radio discs and films. All this material will be highly valuable to extension workers in India. FAO has already emphasized equitable distribution of agricultural machinery and fertilizers on a quota basis. In cooperation with the International Bank of Reconstruction and Development, FAO proposes to render help to less developed countries in the field of credit.

FAO will also maintain panels of experts and will send missions of technical experts to countries which would desire their services. This technical aid will be of value to India.

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FOOD AND AGRICULTURE ORGANIZATION

FAO will be the first of the new permanent international organizations to come into existence. By its constitution the nations joining the organization are 'determined to promote the common welfare' through national and international action. The objectives are to improve efficiency in production and distribution, to raise levels of nutrition and standards of living, to better the conditions of the rural population; and to contribute by these means towards an expanding world economy. The member nations agree to report to one another on the measures taken and the progress achieved.

FAO will link agricultural science with the modern science of nutrition and will collect and disseminate a wide range of statistics. It will be expected to act as spokesman for both producers and consumers in international councils.—*The Veterinary Record*, September 29, 1945.

A RAPID FIELD METHOD OF ESTIMATING MEDULLATION IN WOOL AND A PLAN FOR IMPROVEMENT OF VILLAGE FLOCKS

P. N. NANDA[1], M.R.C.V.S.,
GURBAX SINGH, L.V.P.
and
S. B. MOGRA, M.Sc.
Government Livestock Farm, Hissar

IN order to improve the quality of Indian wool, elimination of medullation in it by selective breeding appears to present considerable possibilities, although the nature of inheritance of medullation is still not well understood. An accurate method of determining medullation is an essential pre-requisite which should be available to achieve the desired objective. The matter has attracted attention only in recent years.

The methods known at present are not quite satisfactory, as the exact amount of medullation in a sample cannot easily be determined. They are either a relative test to obtain an index for high or low medullation or an approximate measurement of medullation.

In ordinary breeding establishments, no method can fully serve the purpose, unless it is handy and gives fairly accurate results. It would appear that the only practical method of determining the amount of medullation in a large number of samples from individual animals is by McMahan's medullometer. The other methods are too lengthy and require several days to analyse a single fleece. The use of the medullometer too, is restricted to laboratories where electric current and technically trained staff are available. With a view to guide field workers, the authors have devised a modified rapid test. It is based on Elphick's benzol method. It is known that a clean sample of wool when placed under benzol, exhibits an intensity of whiteness in proportion to the amount of medullation present. Marked difference in the whiteness can easily be judged with the naked eye. For selecting sheep carrying good quality wool, the easiest course is to take an equal quantity (by weight of samples) from all the animals and place them side by side, under benzol, in a black enamelled tray. From the intensity of whiteness in the samples one can at once pick out the samples from sheep carrying better wool. This method can be used to pick out better quality sheep, but for recording the percentage of medullation in individual animals, which is so essential for selective breeding, it does not serve the purpose. To overcome this, certain standards have been devised. These standards show samples under benzol with different amounts of medullation, varying from 0 to 100 per cent. For studying the approximate percentage of medullation in a sample, the same weight of the sample as in the standards, is placed under benzol and its percentage is determined by comparison. The method, therefore, involves

(a) Making of standard samples from different breeds of sheep and

(b) Studying of samples in the field in comparison with the standard samples.

Making of standard samples

Two hundred small shoulder samples are taken from a particular breed of sheep. After getting rid of free vegetable matter, each sample is first washed with a 1 per cent neutral soap solution at 50°C. and then rinsed twice in petrol at the same temperature. After drying them at the room temperature, 100 mg. of each sample are taken for making the standards. All these samples are put under benzol in an enamelled tray which can accommodate about 20 to 30 samples at a time. Judging from the intensity of whiteness shown, samples can be picked out showing varying amounts of hairiness. These selected samples are then arranged in series according to the percentage of medullation in them. The first one represents zero per cent medullation and the last one 100 per cent. The intervening samples are then allotted arbitrary percentage medullation in an ascending order to indicate increased hairiness. The

[1] Superintendent, Government Livestock Farm, Hissar.

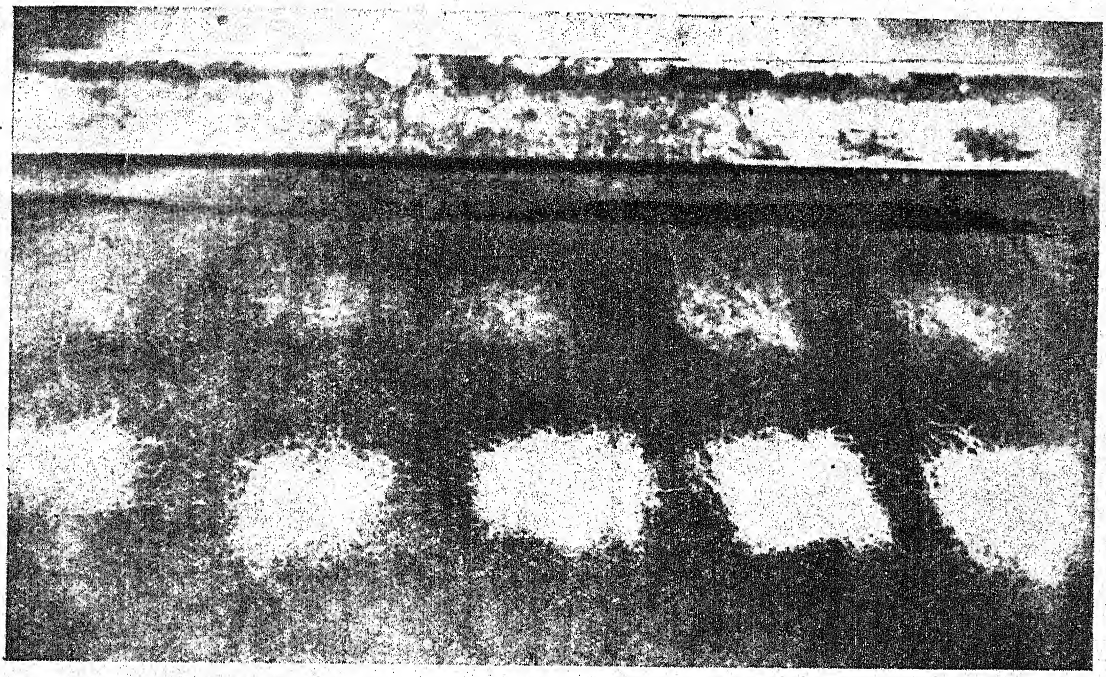

FIG. 1. Samples arranged in series

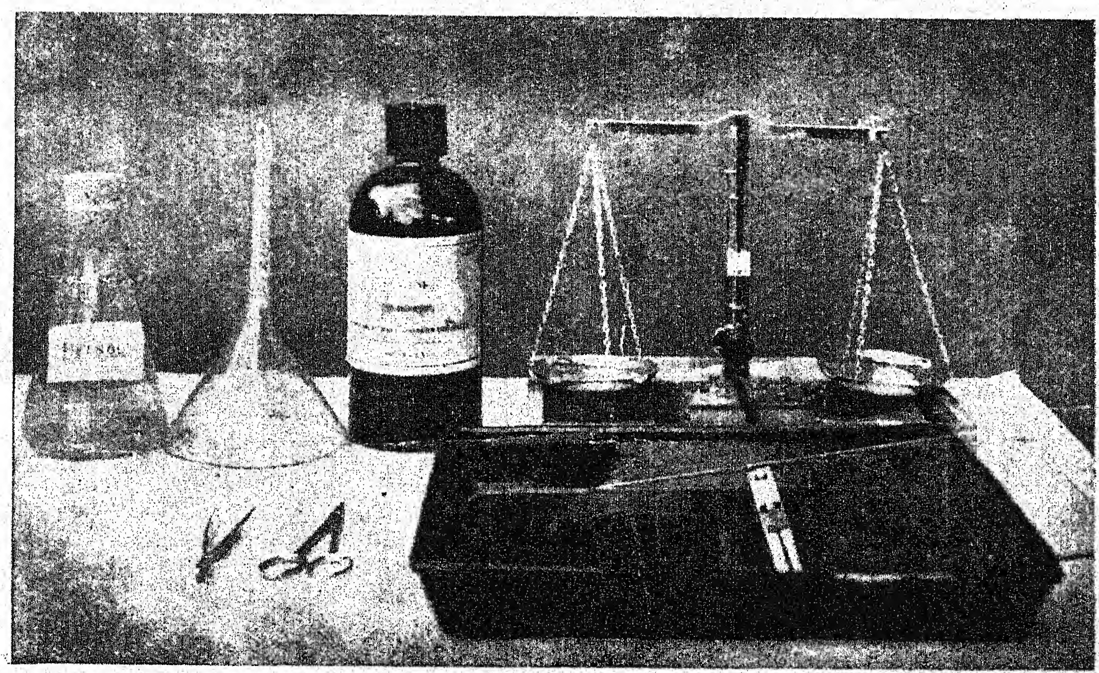

FIG. 2. Outfit for the estimation of medullation in the field

PLATE 6

A RAPID FIELD METHOD OF ESTIMATING MEDULLATION IN WOOL AND A PLAN FOR IMPROVEMENT OF VILLAGE FLOCKS

P. N. NANDA[1], M.R.C.V.S.,
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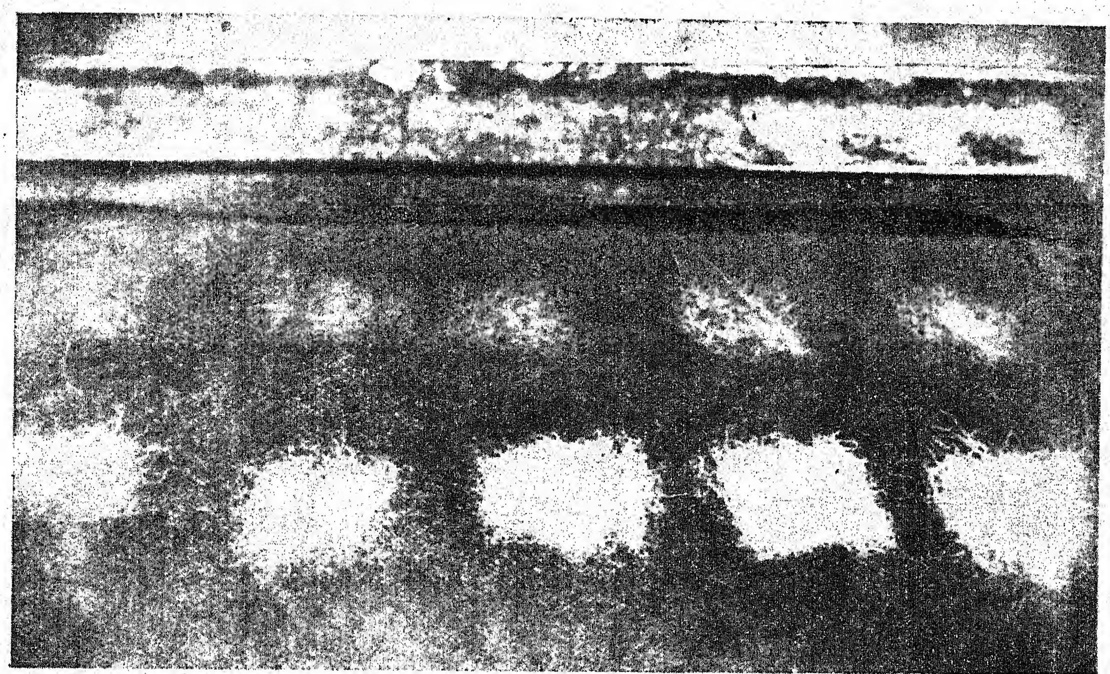


Fig. 1. Samples arranged in series

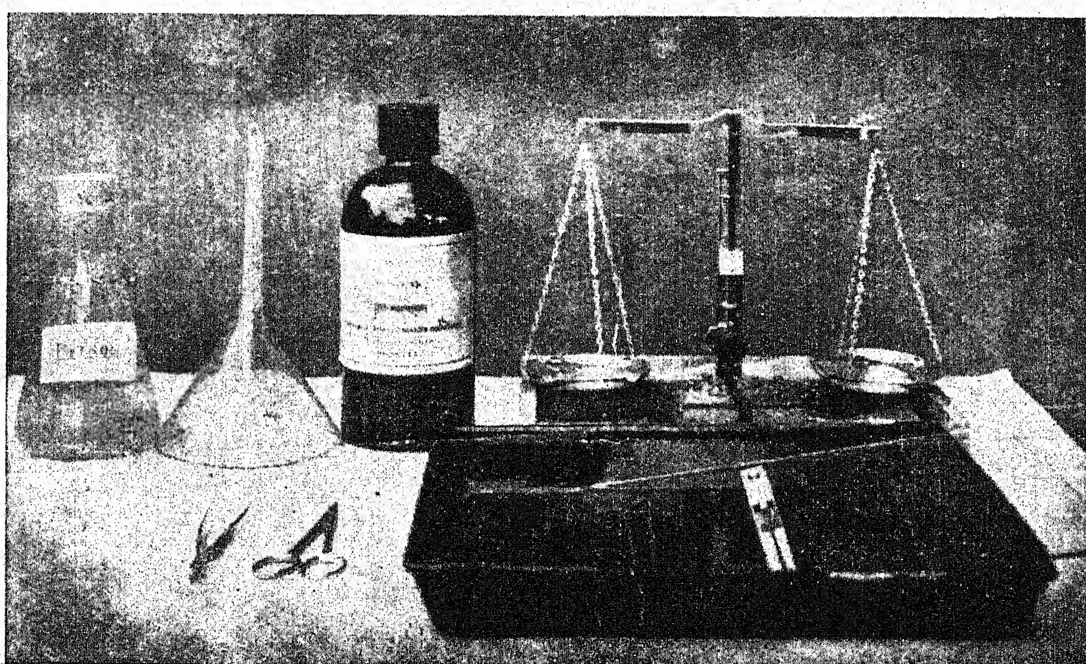


Fig. 2. Outfit for the estimation of medullation in the field

percentages fixed for the samples are according to the intensity of whiteness exhibited by them. To obtain sharp contrasts, the first sample should consist of pure wool and the last of pure hair. The estimation of medullation will be more accurate if a large number of samples are taken to make up the standards.

For more reliable results, the percentage medullation in the series may be fixed by actually ascertaining the exact amount of medullation by the microprojection method. These standards can then be used for the estimation of medullation in any given sample of wool by comparison. To have standards handy in the field, photographs of prepared sets can be used with equal efficiency.

Estimation of medullation in the field

For the estimation of medullation in a fleece, the technique consists in first taking a small sample from the sheep as close to the skin as possible. After cleaning it to get rid of all free vegetable matter and dirt, a small representative sample is obtained from the whole by the halving method. It is then given a free rinsing in petrol for one to two minutes and then allowed to dry. One hundred milligrams of the representative sample are then weighed out by means of a portable balance. This quantity is spread out a little between the thumbs and the fingers and all the fibres are brought parallel to one another. The spreading out is done to the same extent as in the standard print. This resultant sample should present an homogenous appearance. It is placed in the enamelled tray and covered by glass to press down the fibres. Benzol, with a refractive index 1·494 or over, is then poured in the tray till the sample gets immersed in it. By comparing the intensity of whiteness of the sample with the standards, the amount of medullation is estimated. In a tray 8 in. × 10 in. × 1 in. ten to fifteen samples can be examined at a time. A single hand can test 100 to 150 samples in a day. Average medullation in a single fleece can be worked out by testing eight to ten representative samples from different parts of the body of sheep. To begin with, the testing of a shoulder sample is enough for classing and culling sheep under village conditions.

A plan for improvement of village flocks

Although the nature of inheritance of medullation in wool is still not well understood, most of the workers in New Zealand and Australia are inclined to believe that hairiness in fleece is an inherent character. No work on this aspect of the problem has been done in India, but while making a study of about 300 wool samples from *Lohi* sheep, for the study of medullation at the Government Livestock Farm, Hissar, it was noticed that samples with very low, average and high percentages of medullation existed in the ratio of 1 : 2 : 1, both in the flock of ewes and their progeny taken as a whole. The segregation of the medullation character in the Mendalian ratio gives an indication that Indian sheep can probably be bred to produce fleeces with low medullation, but before deriving any final conclusions, planned experiments will have to be carried out. This work has already been taken in hand at the Government Livestock Farm, Hissar, and it has been noticed that the rams with low medullation in their fleece, drop lambs which also show a lesser degree of medullation. However, progeny testing would be necessary before the above can be finally accepted.

A large number of pedigree rams are issued from various sheep breeding farms in India for improving the village flocks, but no attention is paid as to the quality of the fleece, more especially as regards the amount of medullation present. It sometimes happens that the breeding ram already present with a breeder possesses lesser amount of medullation in its fleece than the new ram supplied to him. This is likely to bring about an undesirable deterioration in the quality of the wool in the progeny. To avoid this, it is suggested that only tested rams should be supplied to the breeders. A suitable plan which can bring about substantial improvement in the village flocks would be to establish central sheep farms in areas where promising breeds of sheep exist. The duty of the farm would be to breed pedigree rams and to register all flocks in the specified area, with a detailed record (on specially made duplicate cards) of the analysis of the fleece of rams (average medullation percentage) used for breeding purposes there. One copy of the record would be kept by the breeder and the other at the central farm. The cards will also show the percentage of medullation in the progeny and their dams, so that progeny tests may be carried out to note the transmitting qualities of the rams. It will also be necessary at the farm to study the medullation percentage of the fleeces of male progeny intended to be supplied to breeders for improvement. On requisition for a stud ram for a registered flock,

the owner will be asked to send the history of the ram he is already using. The farm will then allot a suitable ram to him after studying the wool quality of the previous ram, keeping in view that the new ram should in all cases show lesser amount of medullation in its fleece than the previous one. This system, combined with the rapid testing of fleeces in all the ewes as an aid in selection and culling, can bring about rapid improvement in the quality of wool of the village flocks. A special staff for field work would also be necessary to help in the testing of ewes at least once during their life time for replacing culls or for the ear-marking of ewes which are considered unsuitable to be kept in the flock. The breeders will have to see that all the male progeny of their own sheep is castrated before they are five to six months old, and no other ram is used apart from the one supplied by the farm.

NEW YEAR HONOURS

THE New Year Honours list includes several names connected with services to agriculture and animal husbandry:

Knighthood.

H. R. STEWART, Esquire, C.I.E., I.A.S., Vice-Chairman, Imperial Council of Agricultural Research.

F. WARE, Esquire, C.I.E., F.R.C.V.S., Director of Animal Husbandry, United Provinces.

To Companions of the Order of the Indian Empire

R. H. HILL, Esquire, I.A.S., Director of Agriculture, Central Provinces and Berar.

SARDAR GANDASING CHEEMA, Esquire, D.Sc., I.A.S., Horticulturist to Government and Principal, Agricultural College, Poona, Officiating Director of Agriculture, Bombay.

R. C. SRIVASTAVA, Esquire, O.B.E., Director, Imperial Institute of Sugar Technology, Cawnpore.

P. H. CARPENTER, Esquire, O.B.E., Director, Scientific Department, Indian Tea Association, Tocklai, Assam.

To be Officers of the Order of the British Empire

R. H. DASTUR, Esquire, Plant Physiologist, Cotton Physiological Research Scheme, Indian Central Cotton Committee, Institute of Plant Industry, Indore.

B. N. SARKAR, Esquire, M.B.E., Officiating Director of Agriculture, Bihar, and lately Food Controller and Deputy Secretary to Government, Bihar.

To be Members of the Order of the British Empire

J. A. MANAWWAR, Esquire, Chief Marketing Officer, Animal Husbandry Department, United Provinces.

Sardar Bahadur

SARDAR SAHIB SARDAR KARTAR SINGH, Assistant Director of Agriculture, Punjab.

Khan Bahadur

DR SYED HEDAYET-ULLAH, M.Sc. (Cal.), Ph.D., (Lond.), Economic Botanist, Government of Bengal.

Rai Bahadur

LALA BAIJ NATH HANDA, Livestock Development Officer and Assistant Director (Breeding), Civil Veterinary Department, Punjab.

DR KESHO DAS BAWEJA, M.Sc., Ph.D., Deputy Locust Entomologist, Imperial Agricultural Research Institute, New Delhi.

Sardar Saheb

SARDAR DALIP SINGH, Superintendent, Civil Veterinary Department, Lahore Division, and Personal Assistant to the Director, Veterinary Services, Punjab.

Khan Saheb

MR MUHAMMAD RAMZAN KHAN, Animal Husbandry Officer in Baluchistan.

Rai Saheb

BABU M. SEN GUPTA, Assistant Director, Civil Veterinary Department, Bengal.

BABU S. P. SEN GUPTA, Deputy Director of Agriculture (Offg.) Burdwan Circle, Bengal.

Rao Saheb

SRI VARGHESE JOHN, Deputy Director of Fisheries (Marine), Madras.

SRI T. V. MUDALIYAR, G.M.V.C., Livestock Development Officer, Civil Veterinary Department, Madras.

MR V. S. KULKARNI, Deputy Director of Agriculture, Konkan Division, Ratnagiri, Bombay.

MR V. R. A. GOPALA KRISHNAN, G.M.V.C., P.G., Veterinary Investigation Officer, Gauhati, Assam.

MR B. B. DESAI, Deputy Director of Agriculture, Sind.

THE PLACE OF MINOR ELEMENTS IN RICE GROWING

S. P. Aiyar
Agricultural Chemist, Burma, New Delhi

According to present knowledge plants require about a dozen mineral elements for their proper development and maturity. These elements may be subdivided into (a) major elements consisting of nitrogen, phosphorus, sulphur, potassium, calcium and magnesium, and (b) minor elements consisting of iron, manganese, boron, zinc, copper and molybdenum. The elements of both groups are equally essential to plant growth so that the terms 'major' and 'minor' have reference to the total requirements and not to their relative value to the crop. Besides these essential nutrient elements all plants normally contain silicon, chlorine, sodium and aluminium and, occasionally, lead, chromium, cobalt, selenium, iodine and other elements from special soils. These adventitious constituents found in plants are not essential elements and although they are present in small quantities they should not be confused with the essential nutrients classified as 'minor elements'.

Methods of deficiency analysis

The effects of a deficiency are conveniently studied either by culture solution method or in sand culture. Two sets of plants are grown of which one set receives a complete nutrient solution while the other set receives a similar solution from which a specified element has been omitted. The symptoms caused by the deficiency may be deduced by comparison of the two sets of plants in respect of the size of the plants, their colour, shape, the rate of decay of their leaves, their flowering, fruit formation, ripening, maturity, condition caused by necrosis and by other characters. Confirmation is obtained if the symptoms are corrected by restoration of the omitted element. Such experimentation requires the use of extremely pure chemicals and adequate skill and care on the part of the investigator to avoid contamination. The plants grown under a nutritional deficiency will necessarily contain much smaller amounts of the deficient element than those grown in the full nutrient solution. Complete absence of the omitted element cannot be expected owing to the small amount present in the seed and the unavoidable impurity of the components of the nutrient medium. The determination of such small quantities of various elements has been rendered possible by the discovery and use of highly sensitive chemical reagents in colorimetric analysis and in micro-methods and by the use of the spectrometer and the polarograph which unfortunately are expensive instruments and require specially trained staff for their manipulation.

Soil factors

Although the relation of minor elements to the rice crop has not yet been extensively investigated it may be assumed that, in its requirements, rice is similar to other cereals. The quantitative requirement of an element depends on the nature of the crop, and the rate of its supply depends on the soil and other associated factors. The utilization by the plant of the available quantity of an element will depend upon an adequate but a balanced supply of all the other nutrients as well as upon the intensity of light and water supply. An acre of sugarcane, pineapples, tobacco or beans may require very different amounts of boron or manganese as compared to an acre of rice but the differences are of small magnitude.

The soil exerts a dominant influence on the supply of minor elements to the crop either due to an insufficiency of the required element or due to its poor availability. A high clay or organic matter content, excessive assimilation by micro-organisms, the presence of a high percentage of calcium carbonate, or abnormal conditions of oxidation and reduction induced by over-drainage, waterlogging or by addition of fresh organic matter, may all tend to reduce the availability of an element in the soil. Some soils may contain excessive amounts of one or more of the minor elements resulting in toxic concentrations of these. The manganiferous soils of Hawaii are well known in this respect.

The factors influencing utilization of an element by the plant are difficult to control under field conditions. It is worth pointing out, however, that a deficiency of one element may be accompanied by a deficiency of one or more of the other essential elements. In such cases the correction of any one deficiency will

not lead to improved growth until the other deficiencies are also simultaneously made good. The presence of a large excess of a nutrient is somewhat similar in action but is rather more difficult to overcome.

The relationship of each of the minor elements to the rice crop may now be considered. The experimental data are based mainly on the writer's own work in Burma but all relevant published information has been taken into account in the present discussion.

Iron

Chlorosis due to iron deficiency is probably the best known disorder of the rice plant. The symptoms of iron deficiency in the rice plant are (1) reduction, though not excessive, in height, leaf area, tillering and root development and (2) white chlorosis of the young leaves with the leaf tips drying up although the other leaves may remain green. This chlorosis may be easily produced in culture solutions by withholding iron or by maintaining an alkaline reaction or a high concentration of phosphoric acid, both the latter conditions being favourable to the precipitation of iron from ferrous sulphate and similar salts commonly used as sources of iron. Rice requires iron continuously throughout its growth period. In an experiment the maximum yield was obtained with 32 parts of iron per million parts of the medium (p.p.m.) though good growth was obtained with 8 p.p.m. Below 2 p.p.m., however, deficiency symptoms appeared. In waterlogged soils, iron chlorosis of rice is quite rare though it has been known to occur in highly calcareous soils. This unexpected behaviour is due to the fact that soluble iron is nearly always present in waterlogged soils particularly when they contain some organic matter. When iron chlorosis actually occurs in a calcareous soil, manuring with ferrous sulphate is ineffective though repeated spraying of the crop with a solution of ferrous sulphate is generally successful. In neutral or acid soils a deficiency of iron may be corrected by making the soils more acidic by treatment with sulphur or by manuring with ferrous sulphate. For calcareous soils acidification is not feasible but certain organic iron compounds such as the humate and the glycerophosphate can be effectively used in these soils if the prices are suitable for such application. For most soils however the addition of farmyard manure or other organic manures might suffice. The total iron content of a normal rice crop is about 1 lb. per acre which corresponds to 5 lb. of ferrous sulphate. An excess of iron is not known to be toxic to the rice crop.

Manganese

The symptoms of manganese deficiency in rice are as follows:

(1) Initially the plant is chlorotic but at a later stage the bulk of the plant has a dark bluish green colour; (2) the fresh shoot is chlorotic with a peculiar constriction in the middle, about an inch in length, and does not unroll; and (3) the plant is stunted, though not greatly. The roots however remain unaffected. In experiments conducted by the writer, these symptoms did not appear by the addition of manganese sulphate at the rate of 5 p.p.m. of manganese but chlorosis appeared with 1 p.p.m. Further increase in the size of plant and tiller formation was obtained by progressive addition of manganese up to 20 p.p.m. which was found to be the best treatment in solution culture. Beyond this limit toxic symptoms appeared. With 50 p.p.m. of manganese the plant became stunted and chlorotic and the secondary roots were suppressed while the primary roots appreciably elongated. In presence of 100 p.p.m. these symptoms became intensified and the plant died by rotting, possibly due to fungus invasion.

In a waterlogged soil manganese readily goes into solution and in certain cases a toxic concentration may be reached. The total manganese content of a rice crop is about 1 lb. per acre but considerable variation is possible both in this case and in that of iron. A normal soil contains less than 0·2 per cent of manganese though many exceptions are known. Manganese deficiency may occur in very sandy soils as well as in neutral and calcareous soils. Specific instances of manganese deficiency in rice appear to be rare under field conditions. Numerous manurial trials in various parts of the world with manganese sulphate up to 150 lb. per acre or equivalent doses of manganese chloride have given disappointing results. In rice growing the danger seems to lie not in a deficiency of manganese but in an excess of it. The toxic action of an excess of manganese observed in manganiferous areas has been attributed to its adverse effect on the availability of iron. On theoretical considerations the trouble might be overcome either by increasing the available iron or by converting

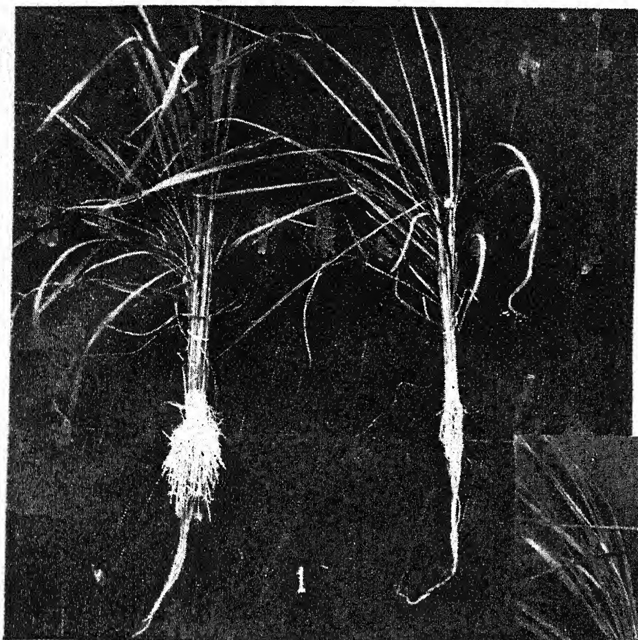


FIG. 1.
Left, complete nutrient with iron 10 p.p.m. manganese 10 p.p.m. boron 1 p.p.m. and without addition of copper or zinc.
Right, without iron

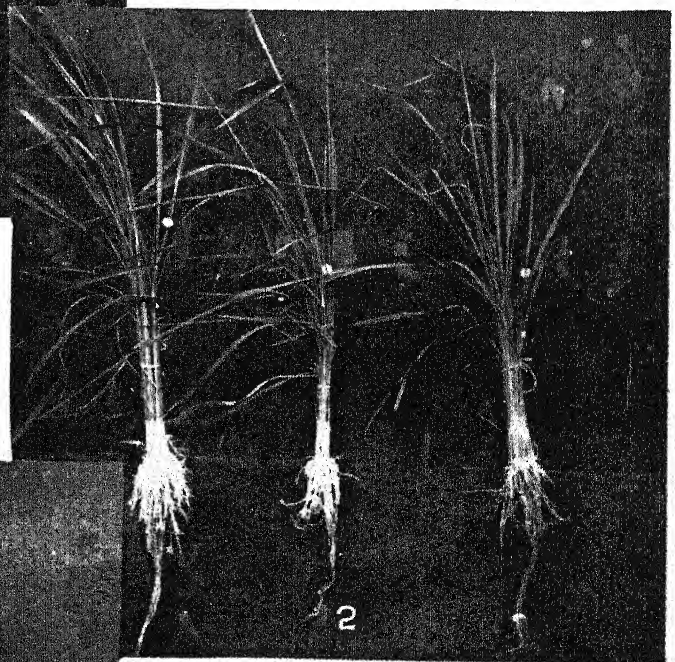


FIG. 2.
Left, complete nutrient as in Fig. 1
Middle, without manganese
Right, without boron

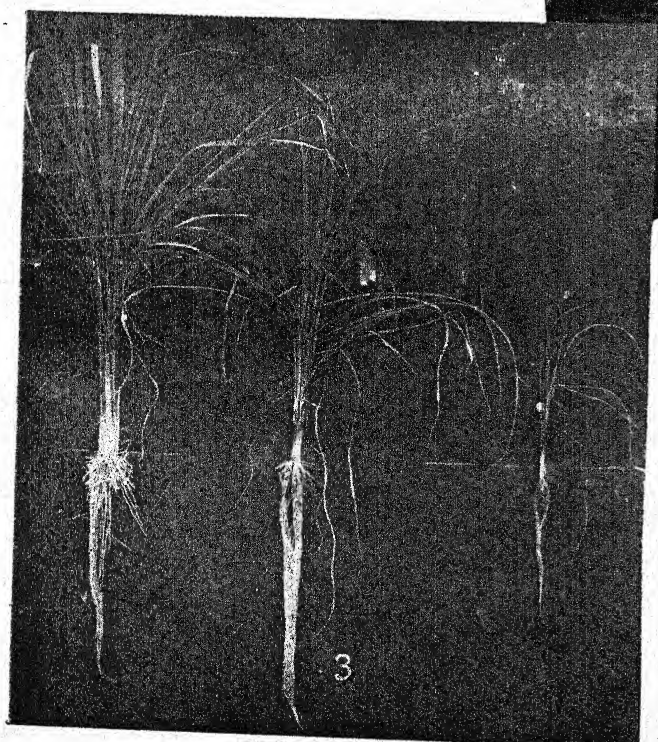


FIG. 3.
Left, complete nutrient as in Fig. 1. but with manganese 20 p.p.m.
Middle, as above with manganese 50 p.p.m.
Right, as above with manganese 100 p.p.m.

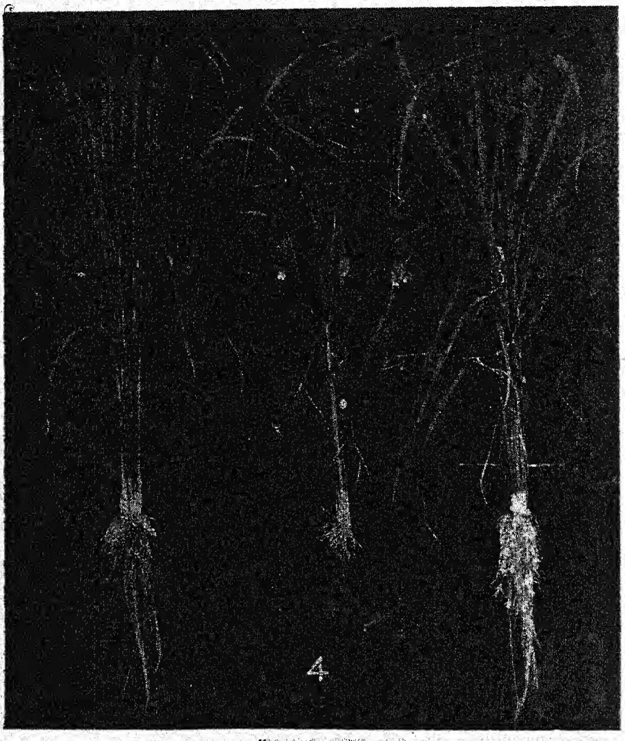


Fig. 4.

Left, complete nutrient with iron 10 p.p.m. manganese 10 p.p.m. boron 1 p.p.m. and without addition of copper or zinc

Middle, as above but with copper 1 p.p.m.

Right, as above but with zinc 2 p.p.m.

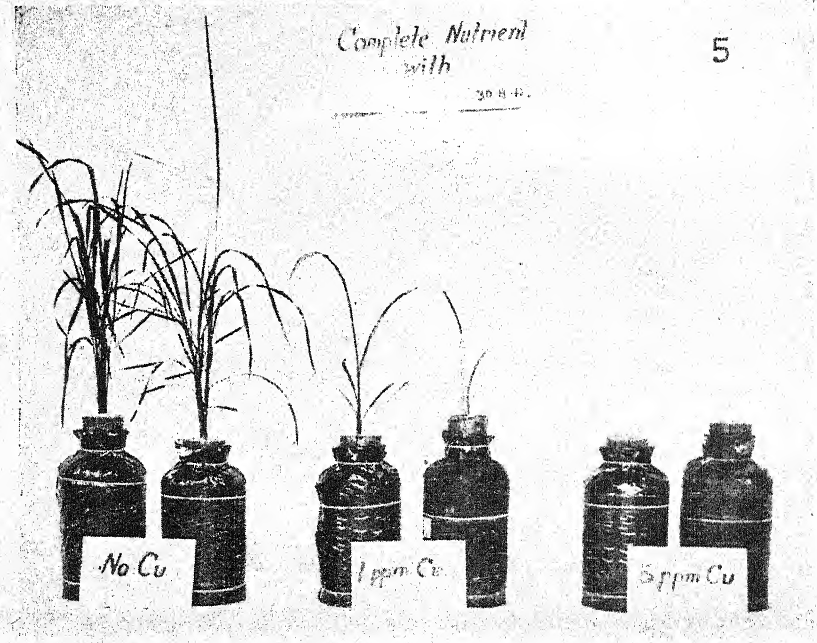


Fig. 5. Left, complete nutrient with addition of copper
Middle, as above with copper 1 p.p.m.
Right, as above with copper 5 p.p.m.

a portion of the manganese into insoluble form. However, manuring with ferrous sulphate upto 1,000 lb. per acre was ineffective but spraying the rice plants at frequent intervals with a solution of ferrous sulphate proved successful. The removal of manganese was achieved (1) by drying the soil before preparing the land for rice growing, (2) by the use of a leguminous green manure or (3) by a massive application of calcium carbonate.

Boron

Boron deficiency in rice gives rise to symptoms somewhat similar to those of manganese deficiency : (1) the plant becomes chlorotic at an early stage but later acquires a bushy appearance with a bluish green colour ; (2) the new shoot is chlorotic with a short constriction in the middle and unrolls only partially ; and (3) the younger leaves have peculiar white margins. In this case also the roots remain unaffected. The onset of characteristic symptoms occurred after about six weeks' growth in culture soution. Boron deficiency seriously affects flowering and grain formation.

In solution cultures 0·5 p.p.m. of boron was sufficient for optimum growth while 5 p.p.m. proved to be very toxic. On the other hand, in soil experiments 2 p.p.m. was optimum for grain yield though no effect was found on straw or roots. Strong toxic action indicated by a general chlorosis occurred with 20 p.p.m. while 100 p.p.m. caused the early death of the plant. Absolute boron deficiency in the field is not common but induced deficiency due to overliming of the soil has been widely reported in many crops. Lime-induced boron deficiency is believed to be due to excessive absorption of boron by micro-organisms and not due to reduction in solubility. The available boron content of a healthy soil is not more than 2 p.p.m. which corresponds to about 5 lb. of boron or 28 lb. of boric acid per acre. The boron content of a mature crop of rice is below 2 oz. so that deficiency must be unusual. Toxic concentration of soluble boron may be introduced into the soil by irrigation water in certain areas or by careless manuring.

Zinc

Zinc deficiency in rice has been observed in solution cultures but no reports of its occurrence in the fields are available. When the concentration of zinc in the culture solution was below 0·2 p.p.m. the young leaves became chlorotic and the plant was somewhat stunted. The growth was optimum with 0·5 p.p.m. of zinc. At 2 p.p.m. the growth was very good but at 5 p.p.m. toxic symptoms appeared in the form of a general chlorosis and at 20 p.p.m. the plant rapidly died. A deficiency of zinc may occur in leached sandy soils, in calcareous and overlimed soils and occasionally in acid soils of high absorptive capacity. Although soluble zinc is highly toxic to plants, direct application of zinc sulphate to the soil upto 25 lb. per acre may produce no injury. For spraying, however, it is essential to convert the zinc into insoluble form by mixing with lime. The small requirement of rice may be supplied by poultry manure or town compost. Excess of zinc may occur in soils near mining centres or in orchards sprayed heavily with zinc salts.

Copper

Copper has always been regarded as toxic to crops and precautions are usually taken to prevent soluble copper, e.g. Bordeaux mixture, reaching the plant. Recently copper has been shown to be an essential nutrient of plants. A deficiency of copper gives rise to wilting and marginal chlorosis of younger leaves. Grain formation is also hindered. In solution cultures of rice the following observations were made : 0·02 p.p.m. of copper gave optimum growth ; 0·05 p.p.m. produced toxic symptoms ; 1 p.p.m. produced stunted and chlorotic plants with few tillers, the primary roots were completely suppressed though the secondary roots were only slightly affected ; with 5 p.p.m. the roots were completely suppressed and the plant died rapidly. In experiments carried out in a soil 50 lb. of copper sulphate per acre produced no effect but 100 to 200 lb. per acre increased the grain yield and 500 lb. per acre was highly toxic. This soil must be regarded as very exceptional and it does not appear safe to add more than about 25 lb. of copper sulphate per acre. In most cases town refuse or sewage sludge can supply sufficient copper for the crop. Copper deficiency is quite rare. It is known to occur in very sandy, highly organic and calcareous soils. Excess of copper may be found in mining districts and in soils subjected to heavy spraying with copper compounds.

Molybdenum

Although molybdenum is known to be essential for plants, omission of this element from an otherwise complete nutrient solution

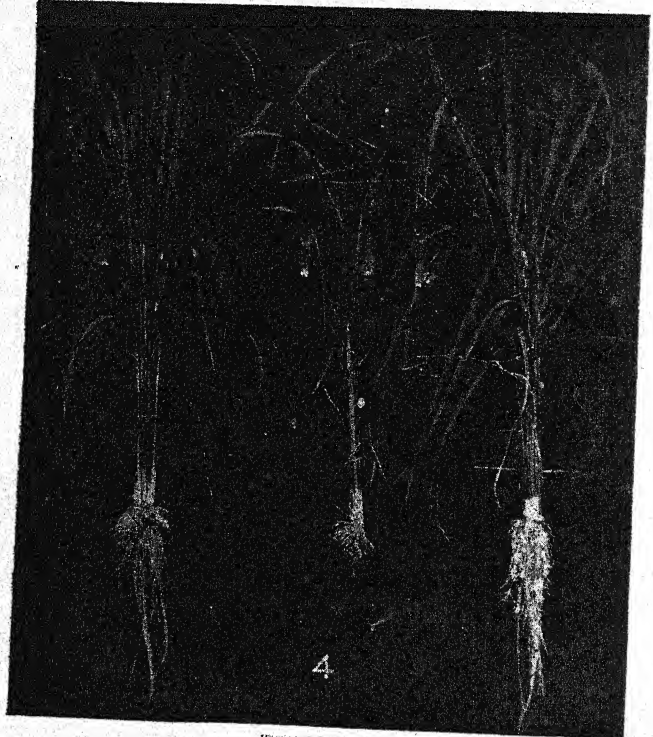
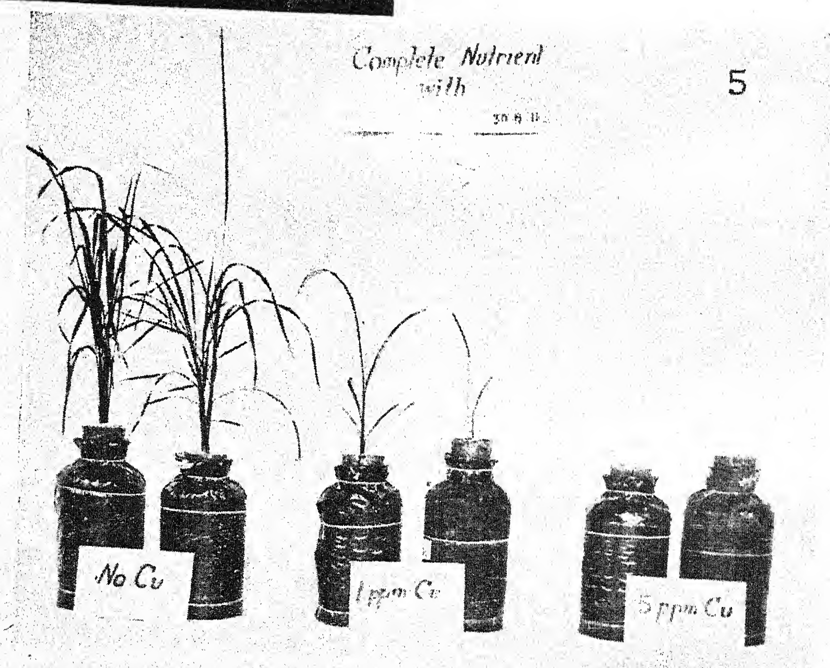


FIG. 4.

Left, complete nutrient with iron 10 p.p.m. manganese 10 p.p.m. boron 1 p.p.m. and without addition of copper or zinc

Middle, as above but with copper 1 p.p.m.

Right, as above but with zinc 2 p.p.m.



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Molybdenum

Although molybdenum is known to be essential for plants, omission of this element from an otherwise complete nutrient solution

did not produce any noteworthy symptoms in rice. The plant however appeared to be taller and healthier when ammonium molybdate was added to the solution to supply 1 p.p.m. of molybdenum. Molybdenum deficiency occurs only in acid soils but not in alkaline or calcareous soils.

Stimulants and poisons

Reference may be also made to the early Japanese work on the stimulating action of certain compounds on the growth of rice. Sodium fluoride has a strong effect at the rate of about 1 oz. per acre but is toxic above 1 lb. per acre. Soluble fluorides are extemely toxic to human and animal life. Potassium iodide stimulates at less than 0·5 oz. per acre, but is toxic to plants at about 3 oz. per acre. Uranium, of atomic bomb fame, and thorium were tested to see if the radio-activity of these elements had any special value for the rice crop. The effect was negative. Cobalt, nickel, and arsenic were found to be toxic even at very low concentrations.

Summary

The information discussed above may be summarized as follows : (1) iron and manganese are required by rice in much larger quantities than the other minor elements ; (2) adequate quantities of iron and manganese are generally present in soluble forms but owing to the action of soluble manganese in repressing the availability of iron, excess of manganese in relation to iron leads to toxicity ; (3) the iron-manganese relation may be controlled by proper soil management ; (4) boron, zinc and copper are required in minute amounts but are highly toxic above the optimum rates ; (5) boron differs from zinc and copper in that its compounds are relatively soluble in the soil under all conditions and that toxicity may develop even from an application of 5 lb. per acre while, on the other hand, soluble salts of zinc and copper become almost completely insoluble in the soil so that relatively larger doses may be harmless ; and (6) minor element deficiencies are not likely to be so common in rice as in horticultural and garden crops and a certain degree of protection against such deficiencies may be obtained from the use of town compost, sewage sludge, poultry manure and other similar manures.

Conclusion

The requirements of rice for minor elements can be assessed only in relation to the soil in which it is grown. These elements seem to be similar to potassium in their effect on the plant in that limited amounts may suffice to produce maximum growth. Unlike potassium most of them are highly toxic except in minimal doses. Minor elements are therefore to be used only when a deficiency is proved to exist giving rise to a disease or disorder and not merely to raise the yield as is the case with the common fertilizers. The regular use of minor elements in rice growing apparently must await the results of future research. It is unwise to use them at present without proper scientific advice.

TWO-WAY PROFITS FROM RICE FIELDS

LOUISIANA rice growers are learning to make double-barrelled profits from their land. Formerly they depended almost entirely upon rice as a cash crop. Now they are turning their rice fields into improved pastures and netting as much as $ 41 per acre from pasture—rice rotations.—Harold Severson, *Southern Agriculturist*, October, 1945.

HAIRY SHEEP OF INDIA

S. C. Chakravarty and Israrul Haq
Central Agricultural Marketing Department

INDIAN sheep can be classified into two distinct types, viz. woolly and hairy. Sheep of the former type yield fleece that possesses wool fibres, fine or coarse, and are mostly raised in the north and north-western parts such as the Punjab, Baluchistan and Rajputana. They are bred for their wool and mutton. Hairy sheep, on the other hand, are thick-set with short hair and there is hardly any vestige of wool on their body. They are found in Peninsular India and are reared primarily for manurial purposes, the production of mutton being of secondary importance. The urine and droppings of sheep and goats, being rich in nitrogen and phosphorous, constitute a readily available form of manure. Shepherds, therefore, graze their flocks (during the day) and pen them (at night) on arable land for manurial purposes, for which they are paid by cultivators in cash or kind according to local customs. It may be mentioned that the system of folding sheep and goats for manurial purposes is a very popular method of increasing the fertility of soil in Central and Southern India.

Habitat and population

The largest number of hairy sheep (9,805,000 heads) is found in the Madras province, where these animals account for nearly 68 per cent of the total sheep population. The entire population in the districts of Nellore, Cuddapah, East Godavari, Vizagapatam, Madras, Chingleput, Tanjore, Ramnad, Tinnevelly, Nilgiris, Malabar and South Kanara comprises hairy sheep. In other districts, the proportion of such sheep varies from 25 per cent (e.g., in Bellary and Anantapur) to 70 per cent (e.g., in Trichinopoly and Madura). In the Nizam's Dominions, hairy sheep account for about 14 per cent (844,000 heads) of the total sheep population. They are particularly concentrated in parts like Nalgonda and Amarabad, and along the banks of Krishna and Tungabhadra rivers. They are also seen in the northern districts of the State. In Orissa, all sheep (366,000 heads) are of hairy type, though the quality of their hair is slightly different from that of the Madras sheep. In the Mysore State, hairy sheep are found scattered all over, and form about 5 per cent (153,000 heads) of the total sheep in that State. Besides these areas, hairy sheep (239,000 heads) are also found in the Madras States, viz. Pudukkottai, Banganapalle, Sandur and Cochin, in varying numbers. In the Central Provinces, hairy sheep are found only in the Chanda district (25,000 heads), while in Travancore, their number is very small (not known).

Adding up the figures referred to above, it may be stated that the total number of hairy sheep in this country is approximately 114·3 lacs.

Breeds or types

The hairy sheep of Madras belong to the *Nellore* breed. They are tall and well-built animals having a coat densely covered with short hair. In the northern districts of this province, sheep are usually white or white with black or fawn markings on head, belly, legs, etc. Animals having light fawn, white with fawn, coloured markings on their back and thighs or light red colour are also met with. In the southern parts, animals are comparatively small in size and have mostly light brown or red coat, though red coat with white patches under the abdomen and on the thighs is also seen. The average live-weight of a *Nellore* sheep is 80 lb. The quality of mutton is good, while that of skins is definitely superior to that of woolly sheep. The sheep abounding in the Mysore State belong to the *Mandya* breed. They produce rather better quality hair than Madras sheep and are a little smaller in size, the average live-weight of an animal being 65 lb. They respond to feeding quickly and, the quality of mutton being good, are in great demand by butchers. They also provide good quality skins. The Orissa sheep are similar to the *Nellore* type, excepting that they are shorter in size and yield slightly longer and finer hair. The average live-weight of an animal of the *Ganjam* breed found in and around the Ganjam district is 65 lb., the mutton being of an average quality. Skins of these animals are of a good quality. The hairy sheep found in the southern parts of the Nizam's Dominions are akin to

Nellores, while those in the northern districts as well as in the Chanda district of the Central provinces belong to the *Godavari* or *Dhormundi* breed. They are white or reddish brown in colour and possess tall and well-developed body, the average live-weight of an animal being 80 lb. They produce average quality mutton and the skins are of a superior texture.

Present-day utility

Hairy sheep are raised primarily for manurial purposes, the production of mutton being of a secondary importance. Since they fatten well and their meat is of a fairly good quality, all surplus animals are killed for mutton production. Their skins being superior to those from woolly sheep, the slaughter of hairy sheep is profitable from the point of view of skin sales. As regards hair, these sheep, as a rule, are not clipped in any part, except the Mysore State where *Mandya* sheep are shorn and their hair marketed after admixture with finer qualities of wool available in the State. In tanneries at Madras, sheep hair of $\frac{1}{2}$-2 in. staple are removed from skins for export to Bangalore, where the woollen mills are said to utilize them in the preparation of articles like coarse blankets. Hair below $\frac{1}{2}$ in. in length is not collected but thrown out as lime waste, which is sometimes employed as manure. These sheep are not important for milk production.

Future improvement

Since hairy sheep produce a fairly good quality of meat and respond to fattening quickly, their future lies in breeding them for mutton. This will not in any way affect their usefulness for manurial purposes. Efforts to cross them with the object of improving their fleece are likely to be laborious and costly, besides involving long-term breeding policies without any certainty of success. The most promising line of improvement appears to be the formation of mutton sheep breeders' cooperative credit and sale societies. This organization will solve three important problems confronting shepherds generally. First, they will throw open to breeders cheap and favourable avenues of credit for purchasing and maintaining their sheep. Secondly, they will bring home to breeders better methods of husbanding sheep by providing them with efficient sires and supplying information regarding opportune times for flushing and mating, the composition of suitable but cheap fattening feeds, the best age for castration, prophylactive and disease control measures, etc. in collaboration with the local veterinary departments. Thirdly, they will enable breeders to market their sheep in a more profitable way by keeping them in touch with markets and their tendencies. These societies should preferably be organized in areas where grazing facilities are available. Wherever it is not possible to organize such societies, veterinary or animal husbandry departments should start ordinary breeding societies like those in the Punjab. In areas where it is not possible to organize cooperative societies at all, possibilities of organizing butchers' associations for financing sheep breeding operations in rural areas should be explored.

Excepting the Mysore State, hairy sheep are not clipped in any other part. This is largely the result of (a) belief that sheep die if clipped, e.g. in Orissa and (b) ancestral tradition of leaving such sheep unclipped, mainly because an effective demand for their hair does not exist. Consequently, there is an annual loss of about 85·7* lac lb. of sheep hair. It is worthwhile, therefore, to carry out propaganda (by the local development departments) that hairy sheep do not die of clipping and that their hair should be regularly clipped. Simultaneously, the local veterinary departments should find out if there is any truth in the shepherds' belief, as there is a possibility of sheep dying of chill or infection if they remain unprotected after clipping or proper care is not taken to use clean scissors. Regarding the utilization of hair, departments of industries should organize cottage industries for the consumption of sheep hair. Wherever possible, they should open purchasing depots and utilize this material in the institutes working under their control. Sheep hair can profitably be utilized for making coarser type of rugs, mats, blankets, up-holstery, linings, etc. Attractive *durries* of multi-colour pattern are likely to fetch more than ordinary type of rough blankets. Sterilized sheep hair can also be used for stuffing pillows and mattresses.

* Calculated at a flat rate of $\frac{3}{4}$ lb. of hair per sheep, as it has been ascertained that if hairy sheep were clipped the annual yield of hair would vary from $\frac{1}{2}$ to 1 lb. per head per annum.

PROCESSING OF SOYA BEAN FOR THE PREPARATION OF MILK AND OTHER FOOD PRODUCTS

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During recent years, considerable amount of interest has centred round the possible utilization of soya bean, which has been acclaimed by many as the 'wonder bean'. The practical importance of the bean and its varied applications came recently very much to the forefront when it came to light that just prior to the commencement of the war, the Germans had stocked huge quantities of the bean amounting to several million tons; that the Chinese and the Japanese, both very hardy races, and admittedly very good fighters, derive a considerable amount of their protein requirement from this bean. It is also well-known that, over certain parts of China, where the pressure of population is so considerable that the maintenance of domestic animals on any large scale is practically impossible, the main protein requirement of the people is derived, in some form or other, from the soya bean.

Industrial and other uses of soya bean

The Chinese have a long tradition, going back to the pre-Christian era, for the use of the soya bean. With centuries of experience, they have developed numerous uses for the bean which practically enters into the everyday life of the people just in the same way as rice, wheat, or *jowar* does in different parts of India. The American tourists in China were so struck with the extensive uses of the soya bean that their Government deputed a number of scientists both to China and to Japan to study not only the different methods of using the bean but also the scientific principles underlying them. The American public took to the bean with much enthusiasm. They have not only learnt to appreciate the value of the various soya bean preparations, but they have also made considerable improvements on the methods of preparing them. Some of the preparations like the soya milk, butter and bean curd are also being produced on a large scale. Other industrial applications of the soya bean have also been discovered during recent years, with the result that very large areas are now devoted to the growing of the bean and millions of bushels of the bean are annually produced and used within that country. The production during 1943 is reported to have been 216 million bushels. The bean is also extensively used in Canada, where soya milk flocculates are largely used for infant foods and similar products.

In Russia there is very intense propaganda for the use of soya bean. Soya bean dishes have been introduced in restaurants and homes. A Soya Research Institute has been organized in Moscow and in a special exhibition of soya food, 130 varieties of soya dishes including cutlets, pastry, salads, candy and beef were shown. A dinner prepared entirely of soya bean was served to representatives of trade unions, factories, the Red Army and the Soviet press. The food was unanimously declared to be excellent.

A conservative reckoning would show that today nearly one-half of the total population of the world is using the soya bean in their daily diet.

Soya bean in India

It is difficult to state as to when the soya bean was first introduced into India, but its use was never very extensive because the different methods of application were not generally known. Between ten and fifteen years ago, an attempt was made by several of the leaders to popularize its use. A fair quantity of the imported beans (probably from Manchuria) also appeared in the Indian market. The results of using the pulse as a *dhal* were, however, unsatisfactory. Many of the users complained of indigestion. The general impression was that the pulse was not much superior to the other Indian pulses. The nutrition research workers also came to a similar conclusion. They found that when fed as such to experimental animals, the pulse had a low digestibility; the protein was also found to have a low biological value. Experiments with school children showed that the cooked pulse could not make a useful supplement to the average diet in the same way as cow's milk does.

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The above findings, though rather discouraging, nevertheless proved valuable in that they show that the soya should not be merely cooked in water if the full nutritive value is to be realized. In fact, a study of the more recent literature on the subject would show that the soya bean should be processed rather drastically to disintegrate the cells before the maximum digestibility and food value can be procured. Among the products that can be thus obtained, perhaps the most useful is the milk.

The soya milk

The Chinese method: The conventional Chinese method of preparing the milk is to steep the pulse for a few hours in water and then grind it to a paste which is then heated with water. The milk, thus obtained, is not very palatable nor is its nutritive value high. It was felt desirable, therefore, to improve this method. The following is the procedure which we use.

The improved method: The bean is soaked overnight in water and then suspended in bags (gunny or any other type will do) to facilitate germination. The bags are periodically soaked in water to moisten them and germination is allowed to proceed for the best part of two days. The skin is then peeled off by rubbing and the kernel heated with about four times its volume of water at about 70°C. (scalding hot but not boiling) for about half an hour. By this treatment, the bitter principle and the colouring matter adhering to the surface of the kernel are removed. This operation is much facilitated by dissolving a small amount of sodium bicarbonate (0·2 per cent) or glycerine (1 per cent) in the extracting water. The extract is then drained off and the kernel washed with fresh water. It is then ground to a fine paste. The paste is mixed with three times its volume of water and the suspension boiled for about half an hour. It is then allowed to stand for sometime when the coarse matter settles down, leaving the milk on top. If necessary, the milk could be further filtered through fine muslin cloth to remove any coarse matter that may be mechanically carried. Additions of a small amount of sugar and a trace of salt improve the taste considerably.

In the usual household practice, it may not always be possible to allow of extended germination though this would give the best results. A useful compromise would be to have overnight steeping followed by about a day's germination. In the absence of adequate facilities, even overnight steeping would suffice.

The flavour and taste of soya milk

The milk obtained in the above manner has a pale yellow colour reminiscent of cow's milk. It has a pleasant, nutty flavour and an agreeable taste. These are quite pleasing by themselves, but as they are foreign to persons accustomed to cow's milk, the best plan would be to add an equal quantity of cow's milk or less, so that the user may get used to the bean flavour. As time goes on, the proportion of cow's milk may be reduced with advantage. Soya milk could also be mixed with tinned milk or milk powder in which case, the smell of the latter completely masks the slight vegetable flavour.

Research is in progress to completely eliminate the vegetable flavour and to replace it with milk flavour. Promising results have already been obtained.

Although a large section of the world is accustomed and even likes the flavour of cow or buffalo milk, it is still an artificial taste acquired at some early age. The Chinese who have been accustomed to soya milk almost from their infancy do not usually like the smell of cow's milk; moreover, they find it indigestible as compared with soya milk.

Nutritive value of soya milk

Apart from the centuries old experience of the Chinese and the Japanese, extensive experiments carried out in America during recent years have convincingly shown that soya milk supplemented with a little cane sugar and calcium could be safely used for feeding even infants. Children grow on soya milk at almost exactly the same rate as they do on cow's milk. Animal experiments carried out by us have shown that, by following the improved method of processing, the digestibility is increased to well over 90 per cent of that of the best cow's milk. The biological value of the protein is also enhanced to practically the same level as that of cow's milk protein.

Possibilities of soya milk in India

It has often been stated that India should increase her supply of dairy products and that the cow or buffalo milk supply should increase at least three-fold. This is, by no means, an easy proposition. The population of the country is increasing at a fast rate and, contrary to all post-war expectations, there is a very lively danger of the available milk supply per

capita actually going down below the present estimated level of 7 oz. per day. Such a situation is already being faced in China and the only way in which the milk requirement of the population can be met is by resorting to vegetable sources like the soya bean.

Uses of soya milk

The soya milk lends itself to a variety of applications in the same way as cow's milk. Perhaps the most attractive among the products is the sour curd which is prepared in the same way as the curd out of cow's milk. The soya milk forms a sweeter curd than the cow's milk which, as is well known, goes increasingly sour on standing. To a section of users, the soya curd is actually more agreeable in taste than the cow's milk curd, but if greater sourness is required, a small amount of cow's milk could be added to the soya milk. The flavour of soya curd is practically the same as that of cow's milk curd, the lactic fermentation modifying the flavour in both cases to the same extent.

Over a considerable part of India, the chief dairy product used by a large section of the population is only the sour curd or the butter milk. Owing to the high cost of cow's milk, the corresponding curd and buttermilk are now becoming increasingly difficult to obtain. Even at the present high price of the bean (roughly 4 as. per lb.), the soya milk costs only about one-fifth of that of cow's milk, so the curd obtained from it would come within easy reach of a large section of the population.

Production of soya bean

Our enquiries have shown that the soya bean can be grown easily over a large part of India. The estimated yield is about 1,000 lb. per acre. If there is sufficient demand, there will be no difficulty in producing the required quantity of bean. The price of the bean will then come down to less than two annas per pound and the inclusive cost of the milk to less than two pice per pound.

Other soya products

There are a number of other soya products such as the sweet junket curd (obtained by adding rennet or some calcium salt), vegetable cheese, *chana* (edible casein) for preparing a number of sweet dishes, butter and cream, different soya beverages, sauces (e.g. the well known Worcestershire sauce), bean flour (obtained by special processing) and so forth. The principles underlying these preparations are fairly well-known, but the conditions will have to be carefully standardized and rendered into a simple routine. Once the importance of processing is realized, we can look forward to extended use of the bean and the different bean products in the country.

In order to give to soya the place to which it is entitled, a threefold programme is necessary, e.g. (a) further fundamental research on soya; (b) encouraging food manufacturers to prepare various soya food products; and (c) education of the public by publications, lectures and demonstrations.

An important step would be the establishment of a soya foundation in order to promote the creation of a National Organization for Soya Research an example of which already exists in the U.S.S.R.

FARMING NOTE

TIME your production for the high-price periods of the year. For most products there are well-defined high and low periods that come each year. It makes a lot of difference in profits whether you sell with the crowd when prices are down, or time your sales for the high periods.—*The Progressive Farmer*, October, 1945.

SHEEP FARMING

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No adjunct of Indian agricultural economy has received less attention during the last several centuries than sheep farming. Sheep have been increasingly associated with mutton and the fact that they produce wool and can produce better and larger quantity has been lost sight of. The result of this neglect is that most of the Indian types of sheep, particularly of the south, have now almost reverted to the wild state and produce only a coarse wool or hair. The average weight of fleece of sheep in India does not exceed two pounds in a year. It is the lowest yield in the world.

A neglected industry

Even to-day, inspite of the very active interest that the Imperial Council of Agricultural Research has taken in recent years in the development and improvement of this very important industry, the prevailing belief is that the rearing of sheep does not require any technique and sheep can better look after themselves. This out-look has been largely responsible for the lack of interest that has been paid to this industry. The writer, who claims about fifteen years experience in the rearing of sheep, both as a large scale commercial proposition as well as an experimental measure and has handled local as well as foreign breeds of sheep, has discussed in the present article some common features of sheep rearing and an effort has been made to show that even the so-called common features require a subtle technique.

Grazing

Unhoused, entirely grass-fed and susceptible to so many diseases as sheep generally are, nothing contributes more towards their well-being than good grazing. Well-fed and healthy sheep can stand adversities of climate and nature's harsh moods better than many other domesticated animals do.

What then is the secret of giving good grazing to a flock? The secret lies in understanding the psychology of sheep, their likes and dislikes, their capacities and limitations. It must be clearly understood that the sheep is a very stupid and panicky animal. Any noise, shrill sounds, hustling, barking of dogs and a host of other causes is apt to put it out of gear. Another prominent feature is that it is very fastidious in taste. It does not like grass which has been trampled upon or soiled in any way. It delights to graze over untrodden nooks and corners, along the sides of unapproachable rocks where virgin grasses grow, over slopes of mountains and hills and on the edges of field divisions. Although it is an omnivorous grazer it prefers soft, sweet and short grasses and herbs upon which it thrives best. It is a truly gregarious animal and has a horror of loneliness. Sheep are very susceptible to the effects of grazing over wet pasturage which often causes distention of the stomach with gases which may result in death by suffocation. Bedewed grasses in mid-winter mornings are responsible for many deaths.

Pasture lands should necessarily have some shady trees and be in close proximity to water supply, preferably fresh water. They should be as far as possible from habitation. The best pasture lands are along the slopes of high mountains with a clearing here and there. The higher the altitude and the less the rainfall, the more nutritive is the grazing. Common experience associates the nutritive value of grazing available in a pasture with its geographical site. The Indian pasture lands which are situated in the north are less rainy, cooler and grow more nutritive grasses and sheep thrive very well on them. Although more grass grows on the southern aspect of hills it is of poorer quality. Sheep in some instances may fatten on it, if the rainfall is not very heavy, but they lack stamina and lose condition quickly in winter and there is high mortality among them. What is needed is abundant light, a dry atmosphere and fine grass. Pastures which are not exposed to sufficient light, either due to their geographical position or to their being too wooded, should be avoided as far as possible. Experience has shown the merit of these generalizations. The conditions referred to above apply to mountain grazing in summer. In plains the best grazing is available along river

and canal banks where generally shady trees are to be found, or in protected forest 'bir' or *rakhas*. Low land, proximity to swamps, catchment and water-logged areas, howsoever luxuriant may be the grass upon them, should always be avoided. The small flocks of land-owners are best grazed over fallows.

A good shepherd should, in the first place, be able to take a correct estimate of the number of stock that he can with advantage maintain on the pasturage available to him. Under-stocking is always preferable to over-stocking. The next important thing is to divide his pasturage into compartments and graze them by rotation. Each compartment has to be further sub-divided for the number of days it has to be grazed and the best shepherd is one who knows how to sub-divide so that his stock each day will get its fill. In grazing over the slopes of high mountains a shepherd starts from the bottom, goes up slowly, letting his flock graze here and there, his sheep gradually putting on more weight and a heavier coat, till by the time the hottest part of the year arrives they reach the top. The snows then melt and the most nutritious, sweet, short grasses spring up. They are the very cream of grazing and bestow a vitality and stamina on the sheep which preserves them in the scanty grazing available in winter. Three to six weeks, as the case may be, the shepherd spends on the higher altitutes with his flock. The rains come and pass away, the stock attains 'top notch' condition, and then slowly the heavy-bodied and heavy-coated sheep start their gradual downward march.

In his daily routine an expert shepherd takes away his flock from camp and proceeds towards his pasture, early in summer mornings and late in mornings in winter when the dew has dried up. The pasture reached, he with a minimum of whistling and shouting, just scatters his flock so that the sheep are in a broken line two deep to three deep. The sheep, hungry as they are, begin to graze greedily. All hustle, barking of dogs and shouting of shepherds during this time must stop. The expert shepherd mutely stands and watches his grazing stock listening for the familiar sound. If he knows his job well he can, with his eyes closed, tell which part of his flock is not grazing properly. In a couple of hours or so the flocking tendency, which has been partly neutralized by the greater need for large grazing area, imperceptibly and slowly reasserts itself and the flock packs closer together. The time then comes when the shepherd, who has so far been quietly watching, advances and moves his flock on to a little distance, then separating it, pushing a sheep here and a dull lamb there, till the flock settles again to grazing. Another couple of hours pass by and by mid-day the flock has had its fill. Sheep like nothing better at this time than to be taken to a nearby watering place where they enjoy a good cool drink and where they can lie and ruminate in the shade if it is very warm or bask in sunshine. The lambs may move about for some time but finally they too settle down alongside their mothers and sleep. After the mid-day rest the flock is moved to fresh pasture but before setting off the sheep should be given another opportunity to water; there are always some who will avail themselves of it. In the afternoon the distance covered should be such as give a certain amount of exercise. Sheep by themselves have little initiative and the work of the shepherd is lightened by the presence of a few goats who act as leaders to the flock. In the late afternoon the movement should be so directed that at nightfall the flock has grazed back to the vicinity of the fold.

Improvement of pastures

As is well known some grasses and herbs are poisonous; some only in the green state, others when dry. A good grazier should be able to distinguish such grasses and herbs. Pastures in which they grow should either be avoided or the poisonous stuff systematically removed for a number of years before seeding time until it entirely disappears. Improvement of pastures is undoubtedly an expensive venture but no investment brings better returns in the long run to a stock owner. Nevertheless some poisonous grasses and herbs will always remain and what an expert shepherd should do is not to take his stock for grazing where such plants are found to be growing in abundance, particularly in the forenoon when the sheep are hungry and their stomachs empty. Poisonous grasses are particularly potent to animals in that state. Young lambs immediately after weaning need special attention because instinct in them is not so effectively developed as to enable them to distinguish between different grasses. It is best to leave one or two adult sheep in such a flock who well lead it to the parts safest for grazing. Ewes-in-lamb should

be carefully guarded against grasses or grass seeds which cause abortion.

Genius of a good shepherd

The genius of a good shepherd lies in his study of the flock individually. He must know all the vagaries of his sheep. It must be recognized that physically the sheep in a flock look like, but temperamentally they are all so different. In every flock there are some 'front line' sheep, healthy, vigorous and always grazing in the front. They get the best feed. They are the very cream of the flock. There are others always following some active sheep and behaving as its 'camp followers'. There is a third group of straggling, unthrifty and dull sheep who prefer to stand about with their necks stretched and their heads thrust between the hind legs of equally lazy animals. Their laziness and consequent lack of grazing becomes a vicious circle. These groups are found in every flock. The art of a good shepherd lies in affording equally good grazing to all his sheep; increasing the 'front line' numbers and reducing the number of sheep in the second and particularly in the third group. All the sheep in his flock must be active, healthy and vigorous: therein lies his success.

CATTLE DISEASE AND MILK SUPPLY

IN London, the House of Lords held a full dress debate on the subject of diseases of dairy cattle and the nation's milk supply. This marks a significant stage in the campaign for combating the major diseases of dairy cattle for the double purpose of protecting the public health and of increasing the milk supply of that nation. When an adequate milk supply has been so produced and so distributed as to guard the consumer against diseases of animals transmissible to man, and also against those human infections which may be carried into homes by the milk, then the consumption of dairy products on an increased basis can do more than anything else to improve the national standard of physical fitness.

The animal diseases of paramount importance are tuberculosis, mastitis, brucellosis, sterility, and Johne's diseases. It was estimated that these five diseases result in an annual loss of more than £23 million, and that 80 per cent of this loss is prevented by the proper use of known methods of control. Plans were discussed for making full use of the veterinarians available, and for training additional veterinarians immediately.—*Veterinary Science Newsletter*, U.S.A. No. 23.

INDIGENOUS REMEDIES AGAINST FOOT-AND-MOUTH DISEASE

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THE medical man in this country has to contend with rival systems of medicine, the adherents of which have clamoured for government recognition from time to time and have even gained some support during recent years. Hard though it is for the practitioner of rational medicine, it is nothing as compared to what the scientifically trained veterinarian has to fight against in this country. The latter is at once confronted with quackery of the worst kind, superstition, witchcraft, and above all, dogmas which have been termed religious. He rarely gets a village animal in his hospital which has not been already tortured by nostrums or charms of various kinds. On the top of it, there is a body of pseudo-patriots who are supposed to be educated and who think that there is much in these indigenous systems and remedies which is unknown to the modern veterinarian or physician. In the present article, an attempt has been made to survey the more common remedies which are recorded in the literature as in use against foot-and-mouth disease in Indian villages. A few remedies of which the author and his professional friends had first-hand knowledge have been added. It is realized that this survey is not complete, but it should suffice to warn intelligent farmers against their use, and it may help to lift the obscurantism of some of our educated compatriots. It is high time that we should place our animal husbandry on a purely scientific footing.

Foot-and-mouth disease has been selected as an example for this survey, mainly because it is easily diagnosed by the villager and is widely prevalent. It must be pointed out that the disease in India is generally mild and the chief criterion of a remedy against it is not the saving of life. The remedy should be such that it prevents complications and helps the sores to heal in normal time.

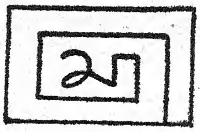
Charms and jujus

In the villages and towns of northern India the horns and hoofs of cattle are coloured with red earth (Hind. *geri*, *geru*) as soon as foot-and-mouth disease appears in the locality. Rarely, this colouring is done in the case of other contagious diseases and is supposed to afford immunity against disease in general and foot-and-mouth disease in particular. To the veterinarian, it affords an easily noticeable sign of the existence of contagious disease.

In parts of southern India, an elaborate operation is performed when a large number of animals are to be protected from the disease or affection. Two platforms (each about one square foot in size) are erected in the jungle opposite to each other, one to the east and another to the west. At about 3 p.m., five pieces of *bewachellor* quartz are placed to the east of the western platform and three to the west of the eastern platform. After this, certain *poojas* are performed to the native bugle called *balay* and the palmira leaf. A kid is then killed in the eastern direction, its intestines tied to the trees in the north and south, and the blood flowing out of its belly collected. The herd of cattle is then made to pass from the west to the east over the flesh and stones, when the blood already collected is sprinkled over them. In the evening, when these cattle enter their pound, another kid is killed near the entrance and its blood, flesh, etc. are spread all over the place. It is not permissible to kill a goat instead of a kid, for the purpose. On the following morning, *haraka* (horse-gram, *Curcuma longa*) mixed with *tyre* (curd) is sprinkled over the cattle at 5 a.m.; this is continued for three days. If less than 10 animals are involved, the mouth and feet are washed with a decoction of the bark of a plant called *putchari chekki* (? *Debregeasia velutina*). At the same time, a wet cloth plastered with red earth is applied to their backs, the whole appliance being kept wet by sprinkling water over it. In parts of central and western India also, earths of various kinds are applied to the backs of affected cattle, with or without the admixture of some leaves.

In certain areas of Mysore, water in which fish have been washed, is used to bathe the mouth and feet of healthy cattle and the same

fluid is sprinkled in and about the cattle-yard. This is supposed to prevent or mitigate the disease. Affected animals are also treated with fish washings, a hornful being also given as a drench. In some villages, the animal is marked on the left flank with freshly slaked lime thus. In some cases, this mark is made with the hot iron. At the same time, the mouth is washed with old



tamarind soaked in tepid water and fumigated with burning sulphur.

Certain common religious practices aiming at the prevention or suppression of contagious diseases among animals may well be classed with the foregoing charms.

Medicinal remedies

The number of medicinal agents employed in the treatment of this disease is a legion. Several kinds of minerals, barks, roots, leaves, seeds, pulses, oils, fats, ashes, juices and animal products are used as dressings; even urine is employed for the purpose. The nostrum used and the method of its preparation and application differs from village to village. A detailed survey of all the medicines used would fill a volume. A few typical and more commonly practised methods are mentioned in the following lines. It will be seen that many of the remedies are absurd, others are slightly useful but very wasteful, and still others are difficult to assess.

In northern India, the mouth lesions are generally treated with flour of pulses like *urd* (*Phaseolus mungo*), *masur* (*Lens esculenta*), and *moth* (*P. aconitifolius*), which is made into cakes with *ghi*, butter or oil, some salt, *ajwain* seeds (*Carum copticerm*) and brown sugar being sometimes added. These cakes are given as hot as the animal can bear and are forced down his throat. The rupture of vesicles resulting from this mishandling is considered to be an achievement. At some places, powdered *ajwain* seeds are made into a bolus with *gur* (brown sugar) and butter to be fed to the animal. Another common practice, which very much approximates the rational treatment is the washing of lesions with an infusion of *babul* bark (*Acacia arabica*). Such infusion is, however, generally obtained from the village tannery and is thus liable to contain disease-producing germs. In some districts, half-a-seer of *gur* (brown sugar) is placed in the mouth of the animal which is kept shut by tying a string around the muzzle for 12 hours. For foot lesions, which are supposed to be caused by an imaginary bird *mahara* pecking at the cleft of the hoof, red oxide of lead (Hind. *sandhur*) is made into a paste with lamp-black and oil and applied locally. Ashes of *jand* leaves (*Prosopis spicigera*) are similarly used. When there are maggots, a poultice made of lime and peach leaves is applied.

In central and in parts of western India, the mouth lesions are treated with applications of turmeric mixed with butter-milk or of tooth-powder consisting of finely-powdered burnt almond shells mixed with common salt. The usual plan is to spread the powder on a ripe plantain, expose it to the night dew and thrust it into the mouth of the animal next morning. At the same time, butter or oil is rubbed on the horns. For foot lesions, several dressings are used, among which are crushed *kaith* leaves (*Feronia elephantum*), tobacco and lime leaves, *dikmali* oil (*Gardenia gummifera*, *G. lucida*), equal parts of sesame oil and lime, *bhelawa* (*Semicarpus anacardium*) and teak oil, mixture of lamp-oil, *dammar* (*Vateria indica*) and camphor, *bawanch* oil (*Psoralia corylifolia*), asafoetida and alum. In some places, *madar* leaves (*Calotropis gigantea*) are boiled in urine and sprinkled on the sores. After using some of the foregoing foot dressings, the part is plastered with mud or the animal is made to stand on hot earth.

In southern India, ripe cooking plantain is dipped one-fourth part in sesame oil and given to the animal to swallow. Water in which fish have been washed is used as a mouth wash and given as a drench. *Ragi* gruel, with or without plantains crushed in it, or rice gruel is given as feed.

In certain districts of eastern India, a marking nut (*Semicarpus anacardium*) is wrapped in a *chapati* and fed to the affected animal. If it causes a loose motion, it is said to have produced the desired effect. Flesh of a tiger, when available, is given as a curative or preventive in this and other diseases.

The importance of 'blowing' (deposition of maggots) in the foot lesions is generally recognized all over the country. The usual village method of preventing this complication is to keep the animal standing in water or mud for varying periods each day. This operation, if sufficiently prolonged, generally achieves this purpose but the mud and sand which gets into the lesion, delays its healing considerably.

What should be done?

No condemnation is too strong for the charms and allied practices. They are not only useless

but often harmful and wasteful. The same can be said of many of the medicinal agents mentioned above. An intelligent farmer must never listen to his neighbour, servant or tenant who advises any of the foregoing charms or nostrums in the treatment of foot-and-mouth disease. He should, instead, carry out the cheap, simple and effective rational treatment outlined below. The medicines required are easily procurable in the Indian bazaar.

When the disease has broken out in a herd, it is usually impossible to save the unaffected animals. In such cases, it is advisable and expedient to spread the disease in the herd by artificial means. It is usually done by rubbing the infected saliva in the mouth of healthy animals. The disease resulting from this and natural infection is treated in the same way. The affected animal should be kept at rest in a clean dry place until the sores are completely healed. If the floor is *kuchcha*, the earth should be frequently changed; the mouth should be cleaned with weak borax (Hind, *sohaga*) or alum (Hind. *phatkari*) lotion, two per cent. The feet require more attention and should be frequently washed with a weak solution of copper sulphate (Hind. *nila tootia*) made by dissolving a drachm of the drug in a quart of water. If frequent attention is not possible, the sores in the feet should be smeared with stockholm tar (Hind. *luk*), in which one-tenth part of finely powdered copper sulphate has been thoroughly mixed. When a large number of animals are to be treated it is economical to construct a foot bath, such as can be readily devised by placing a tarpaulin sheet in a shallow pit and placing a temporary fence on either side. This bath is filled to a depth of about six inches with the weak copper sulphate solution mentioned above. All the affected animals are made to wade slowly through this bath, twice or thrice daily. This treatment suffices for mild cases but severe and complicated ones should be attended to individually. If maggots are noticed in any of the sores, they should be carefully picked out with forceps and the cavity plugged with cotton soaked in turpentine oil (Hind. *tarpeen ka tel*) for two or three days. Thereafter, the sore should be treated as usual. The feed given should be soft, e.g. green grass, mashes or gruels.

When a herd is unaffected at the time when the disease has made its appearance elsewhere in the village, it may be possible to save the former by a complete and rigid isolation several hundred yards away from the village. All kinds of communication between the affected and healthy animals should be stopped. The isolation should continue up to one month after the last animal has developed the disease. Such isolation is not worth attempting, if it cannot be complete and rigid.

LIVESTOCK INFORMATION

DECISIONS of importance to the livestock industries of Australia and other Pacific countries were reached at the International Veterinary Conference called by UNRRA, and held in Sydney, last month. Conference approved the formation by UNRRA's South-West Pacific Area Office of an International Veterinary and Livestock Secretariat. This secretariat will collect and circulate to member nations information on animal diseases, particularly those affecting traffic in animals and animal products for relief and rehabilitation. The secretariat will also circulate information on the breeding and feeding of livestock, as these are important factors in rebuilding flocks and herds reduced or destroyed by war. Conference received a cablegram from the Director-General of UNRRA (Mr. Herbert H. Lehman) declaring that rehabilitation of war-devastated livestock was one of the world's important food problems. Representatives of the governments of Australia, China, India, Netherlands Indies, New Zealand, Philippines and United States, and of the commands of Admiral Mountbatten and General MacArthur, attended.—*Australian Agricultural Newsletter*, January, 1946.

SEX DETERMINATION OF CALVES IN RELATION TO SERVICES

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ONE of the mysteries of nature, which has exercised the minds of the common man as well as the scientific worker, is the predetermination of the sex of the future off-spring. Although several experiments are said to have been made in this direction not only from the point of view of scientific curiosity but also with a view to determining the conditions necessary for obtaining either male or female offspring as desired, no satisfactory explanation has yet been given. Apart from other considerations, such a knowledge would particularly be of immense economic importance to farmers and breeders. The dairy farmer is always faced with the problem of securing sufficient number of female calves and male calves in proper time so as to maintain a uniform proportion of milking animals in the dairy herd and also to obtain work animals and breeding bulls according to his requirements.

Sex and time of service

There have been reports of several attempts made at predicting the sex of the offspring mostly based on the physiological conditions of the animal during the period of gestation. Such predictions, however, have not always proved correct and moreover this belated knowledge does not help the farmer or breeder to obtain a calf of the desired sex. There is a belief that the time of service might possibly bear some correlation with the sex of the calf but there is no evidence in literature of any systematic efforts made to investigate this point. In a note[1] by Chakrabartty, it has been stated that in his personal experience of 28 cases of bull services, he found that those cows which were served in the forenoon (7 a.m. to 12 noon) gave birth to male calves and those that were served in the afternoon (12 noon to 6 p.m.) gave only female calves. If such a relationship between the time of service and the sex of the calf is really found to exist, it would no doubt prove a very valuable boon to the breeders in that they could easily regulate the times of services of their cows according to their requirements of either male or female calves in the dairy herd.

Tests at Bangalore

In order to verify the above statement and also establish whether any such correlation existed between the time of service and the sex of the calf, observations of the times of services of 22 stud bulls of the Scindhi, Gir, Ayrshire and Murrah breeds and the sex distribution of their progeny were made at the Imperial Dairy Research Institute, Bangalore. Altogether 167 services in the forenoon and 148 in the afternoon, covering a period of over two years, have been observed and the sex distribution of the resulting calves is shown in Table I below.

Table I

Correlation between time of service and sex of calf

Breed	No. of bulls	Forenoon services			Afternoon services		
		No. of services to cows	No. of calves		No. of services to cows	No. of calves	
			Female	Male		Female	Male
Scindhi	11	99	45	54	78	39	39
Gir	6	35	18	17	41	25	16
Ayrshire	2	17	5	12	20	8	12
Murrah	3	16	11	5	9	4	5
Total	22	167	79	88	148	76	72

It will be seen that out of 167 services in the forenoon 79 female and 88 male calves are born. Out of 148 afternoon services 76 female and 72 male calves are born. Thus there is apparently no relation between the time of service and the sex of the offspring and there is also no appreciable difference between the forenoon and the afternoon services as regards the sex distribution of calves. Even in the case of particular breeds the same equal sex distribution of calvings between forenoon and afternoon services is observed. Where there is preponderance of male calves from the forenoon services, the corresponding preponderance of the female

[1] *Indian Farming*, April 1942, Vol. 3, No. 4, p. 232.

calves from the afternoon services, as expected, is not found and *vice-versa*.

Service by individual bulls

The possibility that the tendency to throw calves of any particular sex depending upon the time of service might be an individual characteristic of any bull used for the service was also considered and observations made in respect of the services of six stud bulls at the Imperial Dairy Research Institute Farm are summarized in Table II below.

TABLE II

Correlation between time of service and sex of calf (Individual Bulls)

Name of Bull	Forenoon services			Afternoon services		
	No. of services	No. of calves		No. of services	No. of calves	
		Female	Male		Female	Male
1. Victory (Schindi)	22	7	15	21	10	11
2. Erio (Schindi)	30	16	14	7	3	4
3. Unique (Schindi)	17	5	12	17	9	8
4. Wonderful (Gir)	11	4	7	13	11	2
5. Bhagwan (Gir)	6	4	2	13	9	5
6. N. Farmer (Ayrshire)	13	5	8	7	3	4

It will be seen that only one bull, viz. wonderful (Gir) has a tendency to throw more males in the forenoon and more females in the afternoon services, particularly the latter. This may be an individual trait or just a matter of coincidence since the observations are limited in number. As regards others, three bulls, viz. Victory, Unique and N. Farmer, have a tendency to throw more males in the forenoon but do not correspondingly throw more females in the afternoon services. One bull (Bhagwan) throws more females in the afternoon but does not throw more males in the forenoon.

No correlation betwen time of service and sex

It is evident from the foregoing observations that there is no definite correlation between the time of service and the sex of calf as reported by Chakrabartty. Probably his observations relate to one particular bull which may have shown this selective tendency in throwing calves of a particular sex according to the time of service either as an individual characteristic or by mere chance as in the case of the solitary bull (Wonderful) referred to above. In any case his conclusion is based on too few (28) instances and from the exhaustive observations made at the Imperial Dairy Research Institute, it may be stated that the time of service is apparently of no diagnostic value in determining the sex of the calf.

FARM MANAGEMENT

SELL products when ready for market regardless of the price is a basic farm management principle from which there should be relatively few exceptions—and these few only after thorough consideration and investigation. It will be doubly important to strictly observe it in the adjustment period that is ahead.—*The Progressive Farmer*, October, 1945.

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What the Scientists are doing

SUMMARY OF RESULTS ON THE DETECTION OF ADULTERATION OF *GHEE*

OILS or fats are characterized by certain different physical and chemical constants; and these constants determine the purity or degree of adulteration of the oil or fat. In the case of *ghee* these constants are not rigid as in the case of other oils and fats but variable within a wide range due to natural causes: breed, feed, age, lactation, degree of under-nourishment, etc. This wide margin of natural variation leaves room for very clever and scientific adulteration with the intention of evading food laws. An attempt has been made to find whether these variations follow a definite rule or are irregular. A large number (200) of samples from 18 regions in India were accordingly analysed. It was found that in a general way the natural variations in these constants do follow a well-defined rule, so much so that the results can be plotted in a graphical way.

When one encounters, therefore, an unknown sample of *ghee*, it is analysed to find whether the physical and chemical constants follow the natural limits indicated, or are outside it. Taking a simple case, a *ghee* of R.M. value 35 can be brought down to give a value of 27. The other physical and chemical tests are performed, and one can tell if it is a genuine *ghee* whose constants are normal or an adulterated *ghee* with a seemingly legal R.M. value. The comparison sample must of course be from the same locality.

As a result of this extensive study, it has been found that the following conclusions hold good and these are strongly recommended to every analyst in the country.

(1) There is a very definite correlation between R.M., Polenske and Kirschner values. A graph has been drawn showing this relationship, and a limit set on either side of it also. Any figures falling outside this limit are certainly suspicious and should be carefully studied by more specific tests.

(2) There is also a striking relationship between the R.M. value, the Iodine value and Refractive Index. Here also the relationship indicated must be followed fairly strictly, and the inverse relationship of the R.M. and I.V. particularly is important, though not sufficiently stressed by analysts. For instance, the effect of lowering the R.M. value by the addition of, say an oil (usually of I.V. about 90), is to cause a substantial increase in the I.V. to a figure far higher than that usual for the corresponding R.M. The importance of the Iodine value is therefore stressed, against the recent recommendations of many analysts.

(3) As regards physical tests, the dispersion is recommended where the necessary equipment is available. The points on the graph 'R.I.—dispersion' for cocoanut oil on the one hand and the drying oils on the other are plotted; 20 drops of *ghee* are taken and its dispersion plotted also. Addition of cocoanut oil drop by drop and of groundnut oil drop by drop, and a study of the changes which occur in the dispersion ought to indicate in what direction the adulteration, if any, lies.

The fluorescence test, carried out after bleaching the *ghee*, should also be of use where ultra-violet light can be had; the results can as yet be only qualitative.

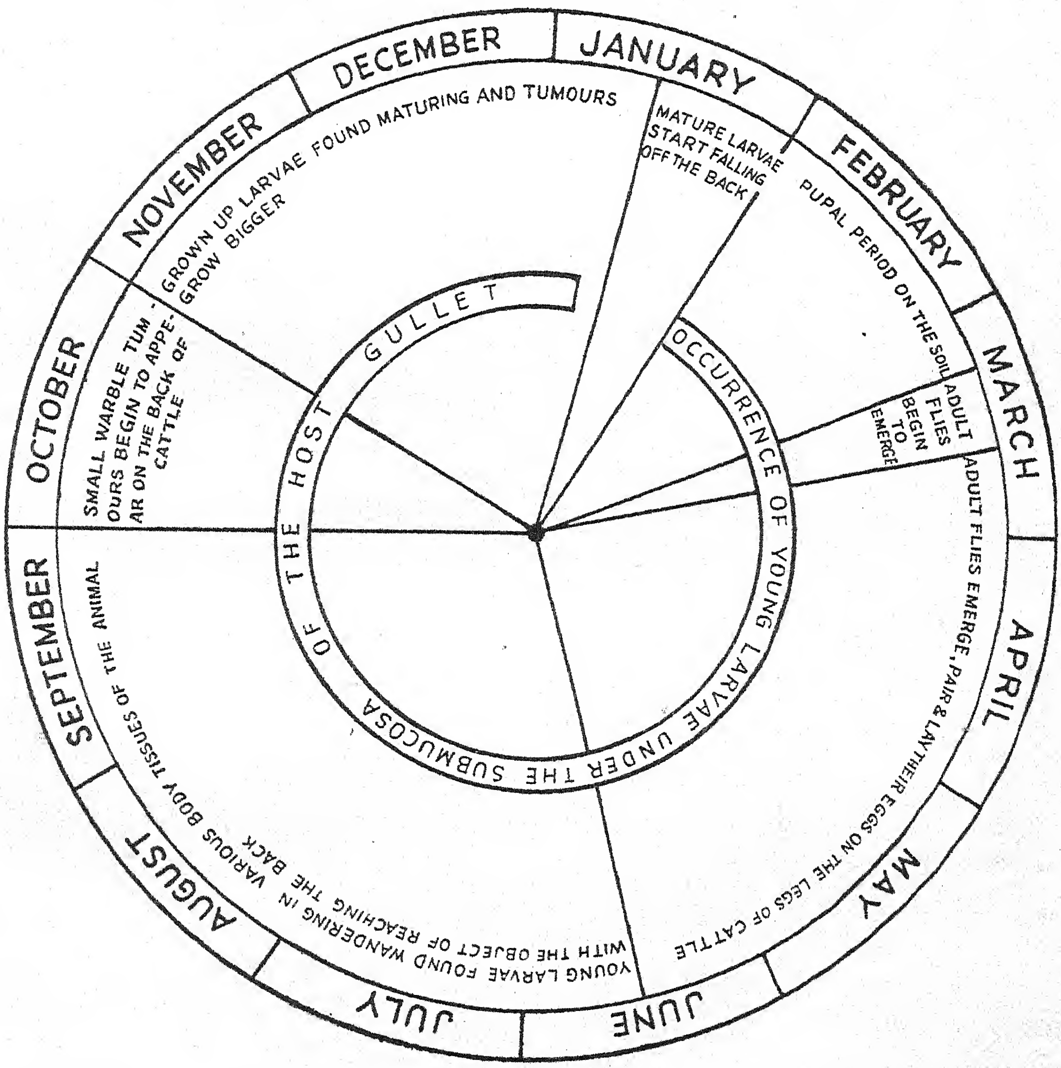
(4) The evil of adulteration can never be prevented, however, without legislation which goes to the root of the matter. It is strongly urged that the Government move that 5 to 10 per cent of sesamum oil be added to all hydrogenated products before sale. Only then can this evil to the public be terminated.—*Department of Biochemistry, Indian Institute of Science, Bangalore.*

SEASONAL OCCURRENCE OF OX WARBLE-FLY IN INDIA

AS a result of an investigation carried out at the Imperial Veterinary Research Institute, Mukteswar, it has been possible to prepare a seasonal occurrence calendar of ox warble-fly in the plains of India. The calendar is illustrative of the facts which could be utilized for the systematic campaign of control measures against this parasite which causes serious and widespread damage to hides and skins in this country.

A report published in the *Veterinary Record* (March 1935), under the heading 'The Warble-fly Campaign in Scotland', includes a review of Dr Stewart MacDougall's experimental work

SEASONAL OCCURRENCE CALENDER OF OX WARBLE-FLY (HYPODERMA LINEATUM) IN THE PLAINS OF INDIA



on the control of this pest. In this review it is suggested that 'dressing for the destruction of larvae must begin by the third week of March'. This suggestion is based on the observation that, in Scotland, as illustrated by a seasonal occurrence calendar, the earliest larvae mature, press themselves out and fall away from their hosts after the second week of March. Similarly, the seasonal occurrence of *Hypoderma lineatum* in India when represented by means of a calendar for the round of the year, as worked out by Mr. B. N. Soni, would show that the earliest appearance of the mature larvae on the backs of cattle occurs sharply after the beginning of October and continues till the end of January. So the dressing operations for the destruction of larvae must be spread over this period of four months in India.

From the same calendar it could be observed that soon after the middle of March the adult flies emerge, pair and lay their eggs on the legs of cattle. Advantage could be taken of this fact when organizing control measures by means of preventive methods such as singeing operations for the destruction of warble-fly eggs. —I.V.R.I.

SHEEP BREEDING FOR WOOL

FOR breeding pedigree sheep bearing wool of the desired standard, investigations for which the Imperial Council of Agricultural Research is giving financial aid, are in progress in various parts of the country.

At the Hosur Cattle Farm in Madras, research is being done with the object of evolving a white wool sheep yielding wool better in quality and quantity, and also a heavy carcase suitable for mutton. The problem is being approached in two ways—by selective breeding and by cross breeding Bellary ewes with Bikaneri rams.

The systematic improvement of the Bikaneri breed is being attempted at the Government Cattle Farm, Hissar, in the Punjab. Apart from improving the wool, the economics of hand feeding, of the production of one lamb against two in a year, and of washing and shearing, are also being studied. The soundness of results obtained on the farm is being tried out on surrounding village flocks and approved rams are being distributed in villages for use on the local stock.

The main object of the research in sheep breeding at the Poona Research Station, is the improvement of wool-carrying capacity of the Deccan sheep by selection and by crossing with the Merino, and to study the adaptability of the Merino to the Deccan climate. Extension work with the rams improved by selection is being energetically pursued and is very popular.

Under the sheep breeding scheme at Monghyr in Bihar, breeding by selection and feeding experiments in sheep are being performed with a view to rearing and distributing rams.

The systematic improvement of a large flock of sheep of the Bibrik type is being carried out in Baluchistan where it is intended that stud rams of improved quality will be issued to villagers. Investigation in local sheep diseases is also being carried on. The effect of crossing some breeds of Kashmir ewes with merino blood is being studied at the Government Sheep Breeding Farm, Banihal. The economics connected with these improvements are also under study.

Wool analysis laboratories have been established at Matunga, Poona, Punjab, Baluchistan, and Baroda, to determine the wool quality of sheep in different parts of the country, and to classify and assess the value of various breeds and individuals by their wool characteristics. The nature of the change in wool quality brought about by cross-breeding and other factors at the stations is followed in order to arrive at fixed types of improved breeds which will flourish in the country.

An investigation of the fine wool potentialities of indigenous breeds in Kashmir and the Nilgiris is contemplated.

What would you like to know?

Enquiries regarding agriculture and animal husbandry should be addressed to the Directors of Agriculture and Veterinary Services in provinces and states. This section is reserved for replies to selected letters in cases where it seems that the information may be of general interest.

Q. I am very much interested in canning and preservation of mango products. Will you please let me know (a) the method of preparation of powdered raw mangoes (*Am-chur*) and (b) the method of preparation of dried mango juice (*Am-papar* or mango leather) ? (G.V.R.).

A. (a) Powdered raw mangoes are locally known as *Am-chur*, a product which is liked for its high acidity. The solution or a thin paste of this product is generally used as a savoury with food in most parts of India. Sour mangoes are, therefore, the best for this purpose. Raw mangoes free from rot and blemishes are selected for the purpose and washed thoroughly. They are then peeled with *sippies* (*sippies* are flat sea-shells and specially cut in the centre for peeling purposes). *Sippies* are used because (a) iron knives impart black colouration to the fruit and (b) mangoes can be peeled at a higher speed with *sippies* than with knives. From the peeled fruit the flesh is removed in thin slices and dried in the sun on mats. When the slices become brittle or bone dry, they are then powdered by passing through a stone mill.

(b) Dried mango juice is produced in considerable quantity in the mango growing tracts of the Punjab, particularly the Kangra tract. Surplus 'cull' fruit is generally used for this purpose and the methods employed for its preparation are very crude, with the result that the product is very unattractive in appearance and fetches very poor price. Even this product of poor quality is exported in fairly large quantities to other parts of India. Attempt was made, therefore, in these laboratories to develop more hygienic methods for the preparation of this product. The method evolved is as under :

Only sound ripe mangoes free from rot and blemishes may be selected for the purpose although they may be malformed, under-sized or over-sized fruits or fruits which do not appeal to the buyer.

Wash the fruit thoroughly and remove the stem-end portion with a knife. Give four longitudinal cuts around each fruit with stainless steel knife and then pass it through the pulping machine (fitted with a seive of 3 mm. mesh) and collect the pulp thus obtained. Examine the stones and the skin and if the extraction of pulp has not been complete pass them again through the machine. Strain the whole pulp thus collected through a muslin cloth in order to remove coarse fibre.

Note 1. If the fruit is pulpy and hard, it may be macerated by hands covered with rubber gloves before passing through the pulping machine.

Note 2. For home-scale production, the pulp can be extracted by squeezing individual fruit (after removing the stem portion) by hands covered with rubber gloves.

For every 100 lb. of the juice thus prepared weigh one ounce of potassium meta-bisulphite. Dissolve it in water and mix it thoroughly well in the juice. The advantage of adding potassium meta-bisulphite is that it does not allow the juice to ferment in the initial stages of drying. It also helps to retain the good colour of the leather for a considerable period.

Spread the juice thus prepared in thin layers in copper trays lined with tin which are smeared with butter fat or *sarson* oil at the time of pouring the juice. The greazing of the inner surface of the trays facilitates the removal of the dried juice which sticks otherwise. In order to get thick sheets of leather, the juice may be dried in layers, i.e. when one layer dries up another layer of fresh juice may be put on the top.

Juice can also be dried in specially constructed chambers called dehydraters. Usual temperature at which drying is conducted is 140° to 150°F.

The dried juice is then cut into desired length of pieces, wrapped in waxed paper and sent to the market for sale.—(G.L.)

THE PUNJAB

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As an experimental measure, the Punjab has also taken to the scarification method for immunization of animals against rinderpest. The first experiment of these inoculations has just been completed at the Jehangirabad Government Grantee Farm in the Montgomery district, where pedigree Sahiwal cattle are being bred. The techinque of inoculation being followed is the same as stated by Mr. Tufail Ahmed of the Imperial Veterinary Research Institute, Izatnagar, in his article on the scarification method of immunization against rinderpest published in the *Indian Journal of Veterinary Science and Animal Husbandry*, September, 1944. The important observations made so far in this province are :

(i) The thermal response in the animals reacting to the scarification route was delayed, commencing on the 4th, 5th or the 6th day after inoculation.

(ii) The composite thermal reaction charts showed that in cattle (cows, bullocks and calves) the temperature ranged between 100° to 102·4° but in buffaloes between 100° to 103·4°.

(iii) In no case it was necessary to control the reaction with serum during the reaction period.

(iv) There was no interference with feeding or the general health of the animal, nor was any diminution in the milk yield observed.

(v) The technique is very simple and only small apparatus is required with only one attendant.

It has now been decided to carry out these experimental inoculations at different centres in the province under typical village conditions both in the face of the outbreaks of the disease and in its absence.

The first immunity tests are to be carried out in the month of January, 1946, which would be repeated every six months for a period of three years. It is proposed to publish the observations made and the results obtained as soon as sufficient data is collected.

Angora goat breeding scheme

This scheme commenced at the Government Livestock Farm, Hissar from 1 April, 1941. The total amount sanctioned for it for five years was Rs. 10,550 to be equally contributed by the Imperial Council of Agricultural Research and the Punjab Government.

The objects of the scheme were :

(i) To evolve a Punjab type of Angora goat by developing the mohair producing characteristics in a suitable type of indigenous goat, by cross-breeding with pure Angora bucks under the local conditions.

(ii) To popularize the mohair industry in the Punjab.

(iii) To create a nucleus for the Punjab type of Angora goats, so that the pedigree stock may be available for issue to other suitable localities.

It was decided to cross the pure breed bucks with the Himalayan hill goats. The sanctioned strength of the latter animal was fixed at 75 which was completed before the end of March, 1942, from the Kangra district. Hitherto an Angora buck (Mortimer) the property of Major Read, was being used for cross-breeding and the results obtained and the data collected have already been published in the annual reports pertaining to this scheme by the Civil Veterinary Department, Punjab.

For the duration of war, owing to shipping difficulties, the pure Angora bucks could not be imported from abroad. Now that the war has ended, three beautiful pure-bred animals have arrived at the Government Livestock Farm, Hissar, from South Africa. It is hoped that the breeding operations of these animals would no longer be hampered.

Punjab cattle fairs

Inspite of the fact that there is a strict ban on the export of cattle from this province and the prices of the animals are very high, the livestock fairs continue to flourish. They not

only attract a large number of dealers from all over this province, but also from outside. The reports of these fairs are still pouring in, but the following extracts from some of the reports already received are published :

Gohana cattle fair, tahsil and district Rohtak: This fair was held from 20 June 1945 to 27 June 1945. The total number of animals that were exhibited on the fair ground was 10,160, out of which 9,924 were sold. The total amount of prices realized on account of the sales was Rs. 1,78,624 as against Rs. 1,76,042 collected at the last cattle fair. The highest price of a bullock was Rs. 795 and that of a buffalo cow Rs. 825. The District Board collected Rs. 5,649 in fees as against Rs. 5,555 in the previous year. Ninetytwo animals competed for prizes and Rs. 140 were awarded in prizes.

Kosli cattle fair, district Rohtak: This fair was held at Kosli, a railway station on B.B. & C.I. Railway (Meter Guage) between Riwari and Bhiwani from 1 September 1945 to 8 September 1945. Animals were brought for sale from the districts of Rohtak, Gurgaon, Hissar and the Indian States of Dujana Pataudi, Loharu, Jind and Patiala. The breeds represented were the Hissar, the Hariana, the Nagore, the Mewat and the Marwari.

Altogether 11,880 animals entered the fair grounds, out of which 1,228 were sold for Rs. 2,25,442. The highest price fetched by a bullock was Rs. 600 and a bull Rs. 450. The District Board, Rohtak, realized Rs. 7,121-13 as. in fees on the sale of cattle. Two hundred and three rupees were awarded in prizes to the best animals out of 111 that competed for prizes.

Tarn Taran horse and cattle fair, district Amritsar: The fair was held at Tarn Taran from the 7 to 14 May, 1945. Some 4,050 animals entered the fair grounds out of which 2,021 were sold for Rs. 3,28,671. The District Board realized Rs. 6,019 in fees on the sale proceeds. The buffaloes were in the greatest demand. Altogether 1,162 animals changed hands during the fair week.

Rohtak cattle fair: This fair was held from 17 September to 24 September 1945 at Rohtak. Three thousand four hundred and sixty animals entered the fair ground, out of which 308 were sold for Rs. 58,891. The total income to the District Board from this fair was Rs. 1,859-9 as. The highest price for which a bullock and a buffalo cow were sold was Rs. 552 and Rs. 740 respectively. Thirtytwo animals only competed for prizes and Rs. 55 were awarded to 15 animals.

CONTROL OF POULTRY DISEASES IN ASSAM

V. R. GOPALAKRISHNAN

Veterinary Investigation Officer, Assam, Gauhati

POULTRY breeding is very popular in the rural parts of Assam and it is usually a profitable business. The Livestock Section of the Agricultural Department, Assam, maintains breeding stock in the Government farms and helps and encourages the poultry breeders to improve the breed as well as to increase the production. The breeders in the villages bring poultry and eggs for sale to poultry markets in the towns on market days.

There is at present an acute shortage of poultry in Assam. The prevailing high prices as a result of the great demand from the Army, had led to a considerable depletion of even the breeding stock of fowls and ducks in the province. The position is likely to become serious if such a situation continues for long. Hence, efforts are made to replenish the stock and to prevent further slaughter of the breeding stock. Also, immediate steps are being taken to give effect to a scheme for poultry multiplication in Assam. In this respect, control of poultry diseases is important.

Poultry diseases

A scheme for investigation of poultry diseases in Assam was commenced in May, 1942, and certain interesting findings have been made. The major poultry diseases in the province are Ranikhet (or Doyle's) disease, fowl-pox and fowl-cholera. There are other disease conditions that are yet under investigation.

Ranikhet disease, caused by a virus, is without doubt the most important contagious disease of poultry. It is responsible for great losses to the poultry industry. The nomenclature of the disease is somewhat confusing. Outbreaks have

been confirmed for Ranikhet disease while the owners called them 'Fowl-cholera', 'Chicken-cholera', etc. Recently the disease was confirmed by biological tests in various localities such as Government Farm, Tea Estate, Military Supply Depot and also in important towns.

Fowl-pox is a virus disease, fairly widespread in Assam. Vaccination is undertaken, as a prophylactic measure before the seasonal onset of the disease. The susceptible fowls are protected during the months of February and March so that they may be immune against the disease which usually prevails during hot weather.

Fowl-cholera is a bacterial disease, highly infectious and acute, affecting all types of poultry. On microscopical confirmation of the disease, serum inoculation or sero-virus vaccination is carried out, as the case may be. In known affected localities, vaccination is also carried out as a prophylactic measure. This is not as serious as Ranikhet disease in Assam.

Control measures

Control measures are in general, preventive and hygienic. A very important factor that is responsible for the dissemination of the infection or disease is the free and unrestricted movement and transportation of fowls from one part of the country to the other for supplying the needs of the Army and, to a less extent, for civilian use. Diseased fowls have been detected on several occasions in the consignments and no effective measures could be taken for the control so far. The suggestions and advice to the owners in regard to control of disease, are not usually carried out in full, with the result that the disease spreads to various localities.

Thousands of birds are brought from rural areas to poultry markets in the towns. Wholesale and retail dealers purchase and transport them by rail, road and steamer to various parts of the province. The sick birds are disposed of at a cheaper rate and dead ones are simply thrown away. The dealers have hardly any consideration for contagious disease or the spread of infection. The diseased birds are a great menace to other valuable stock.

That some sort of legislation is necessary to control the disease in important localities is now under serious consideration. Hence, steps have been taken to get the Assistant Investigation Officer (Poultry Diseases) empowered by the Local Bodies to seize sick birds brought for sale in the markets, under the Assam Pure Food Act, 1932 (Assam Act IV of 1932). The diseased or sick birds can be seized under the Act, as unwholesome food. Birds brought for sale for the purpose of human consumption fall under the definition of 'food' as defined in the said Act. The seizure of sick or diseased birds and their proper disposal help in two ways, e.g. avoiding unwholesome food to the public and control of contagious diseases, particularly, Ranikhet disease.

Other control measures adopted in farms as well as suggested to poultry owners are :

(1) Segregation and preferably destruction of diseased birds and removal of healthy ones to a fresh ground.

(2) Keeping the run and pen vacant for at least two months, if possible.

(3) Cleaning of pens with antiseptic lotion (Phenyle) and white-washing.

(4) Use of blow-lamp flame for disinfecting various fittings and equipments.

(5) Use of mild antiseptic, like potassium permanganate, in drinking water.

(6) Antiseptic precaution for foot-wear, clothing, etc. of poultry attendants.

(7) Relieving crowded quarters and if possible, to divide the flock into small groups to avoid spread of infection.

(8) Segregation of all newly purchased birds for a reasonable period, say a fortnight. This is important as bazar birds of local purchase spread disease to healthy ones already in stock.

In conclusion, it may be mentioned that the question of the control of poultry diseases has assumed such importance and popularity that a resolution, cited below, was passed in the meeting of the Agricultural and Animal Husbandry Section of the Assam Advisory Board for Development, held at Shillong on the 24 May 1945.

'That in view of the wide prevalence of poultry diseases in the province, the Board requests the Director of Veterinary Department to suggest poultry disease subjects for discussion in future and that the Assistant Veterinary Investigation Officer of Poultry diseases may be invited to attend the meetings of the Board as adviser'.

THE PATTAPUR MIXED FARM

R. L. Kaura, B.V.Sc., M.R.C.V.S.
Deputy Director of Veterinary Services, Orissa

DOVETAILING of crop production and animal husbandry into one 'mixed farming' system results in the utilization of all the byproducts of crops for conversion into valuable animal products and draught power, supply of farmyard manure to enrich soil fertility for greater out-turn per acre and increased employment of the farmer and his family and bullocks. The cultivation of fodder crops not only renders the rearing of livestock and the production of such essential articles of diet as milk, butter, eggs, meat, etc. more economical but the leguminous fodder crops also contribute to the increase of soil fertility. This system of farming distributes income all over the year and enables the farmer to hold his own with the help of his animal products if return from the crops be poor due to seasonal vicissitudes or low market value. The cattle problem seems to dominate the whole question and India has got to take to mixed farming, i.e. cow-keeping, etc. along with agriculture if she wants its villages, peasantry, agriculture and prosperity to survive or recover.

The Pattapur Farm

It is, therefore, with a view to popularize this system which yields the best results under Indian conditions and is of course not new to India that I am writing this brief description of the Pattapur Mixed Farm. This Farm has been highly appreciated by His Excellency Sir William Hawthorne Lewis, K.C.S.I., K.C.I.E., J.P., I.C.S., the Governor of Orissa and by G. Williamson, Esqr., O.B.E., M.R.C.V.S., D.V.S.M., Animal Husbandry Commissioner with the Government of India during their visits to the Farm on 8 January 1945 and 5 April 1945 respectively and both have recommended quick multiplication of such farms which would contribute much to the good of the people and the country at large.

As a result of departmental propaganda Rai Bahadur T. Venkatakrishniyya Pantulu, an educated and progressive farmer, decided during 1941-42 to bring one of his agricultural farms measuring about 14 acres located in his zamindari at Pattapur, District Ganjam under the mixed farming system. To this Farm the free services of an Agricultural *Sardar* and a Veterinary Stockman posted at Pattapur by the Provincial Agriculture and Veterinary Departments respectively are available.

Agricultural activities

The areas under the various crops in the Farm are as follows:

Paddy (followed by *mung* as second crop)	8	acres
Sugarcane	2	,,
Maize (as food and fodder) ..	0·75	,,
Biri (as fodder)	0·20	,,
Cowpea (as fodder) ..	0·20	,,
Tomato and soya bean (by rotation)	0·50	,,
Plantain	0·50	,,
Brinjal	0·50	,,
Ragi	0·50	,,
Potato	0·75	,,
Desi alu	0·10	,,
Total ..	14·00	acres

Elephant grass is grown on bunds and various kinds of citrus, cocoanut and other fruit trees are planted on the edges of plots all over the Farm. These fruits are mostly consumed by the zamindar and his family.

Irrigation facilities are available throughout the year and it is done from a tank having a spring with the help of a portable diesel oil engine pump and from wells fitted with 'tandas'. Manuring is done mostly with the farmyard manure and only a restricted use of chemical fertilizers is made in accordance with the advice of the local Agricultural Officer. 'Gur' making is undertaken at the Farm by improved methods.

The expenditure incurred and the yield and income from the various crops are detailed in Tables I to III.

Livestock activities

The livestock on the Farm consists of 3 pairs of bullocks, 6 local cows, 2 local buffalo-cows 20 local sheep, 10 Ganjam type goats, 1 Hariana bull, 1 Murrah buffalo-bull, 1 Bikaneri ram, 1 Ganjam type buck and their progeny. The Hariana bull, the Murrah buffalo-bull and the Bikaneri ram have been supplied free by the

Orissa Civil Veterinary Department. At the First Orissa Provincial Cattle Show held during December, 1943, animals exhibited from this Farm won two Challenge Cups and Rs. 81 as cash prizes. The animals from this Farm exhibited at the Second Provincial Cattle Show held during February, 1945, again won similar laurels. Almost the entire quantity of milk and wool are used to meet the needs of the zamindar and his family and there has been practically no sale of the progeny due to recent introduction of livestock on the Farm. But it is expected that in due course of time when the number of milch stock and graded Bikaneri sheep multiplies, there will be a substantial addition to the income of the Farm. The dung and litter from the cattle byres and sheep and goat pens are composted by the latest methods, and the use of this large quantity of valuable manure on the Farm has resulted in greater out-turn per acre with a larger profit during recent years.

Increased financial returns

The data kindly furnished by the owner as detailed in Tables I to III clearly show that with the introduction of mixed farming system the net profit has increased from Rs. 667-3as.-9p. in 1941-42 to Rs. 1,711-15as.-9p. in 1942-43 and Rs. 1,976-1a.-5p. in 1943-44. This excludes the income from fruits, milk, wool, flowers, etc. used by the owner and his family. Taking paddy, the staple crop, as an example the increase in net profit is chiefly due to the larger yield per acre, the increase in prices being greatly counterbalanced by the increase in the cost of cultivation due to high labour charges. Although the details of income and expenditure for the year 1944-45 are not yet available, the net profit is anticipated to be still higher.

TABLE I

Statement of income and expenditure for 1941-42

Serial No.	Name of the crop	Area in acres	Yield	Value	Expenditure	Net profit
				Rs. As. P.	Rs. As. P.	Rs. A. P.
1	Maize	1·49	No. 11,718	111- 2-3	55-14-0	55- 4-3
2	Brinjal	0·43	48 md.	82- 1-3	57- 0-3	25- 1-0
3	*Biri* and Cowpea (fodder)	1·10	108 md. 20 sr.	16- 1-6	7- 0-3	9- 1-3
4	Sugarcane	0·75	71 md. 25 sr.	193- 8-9	151- 4-0	42- 4-9
5	Paddy	8·95	190 md.	535- 8-3	188-13-6	346-10-9
6	Tomato	0·20	66 md.	63- 4-0	19-14-0	43- 6-0
7	Onion	0·14	5 md. 23 sr.	24-11-6	21- 0-0	3-11-6
8	*Mung*	4·16	19 md. 33 sr.	60- 5-6	27- 2-9	33- 2-9
9	Potato	1 acre	70 md.	216- 9-9	141- 6-6	75- 3-3
10	English vegetables	0·17	—	61-14-9	29- 1-6	32-13-3
11	Patna pea	0·15	29 sr. 8 ch.	2-14-6	2- 5-6	0- 9-0

Total Rs. 667-3-9

FIG. 1.
A Hariana bull and a Murrah buffalo-bull with indigenous cows and buffalo-cows and their graded progeny

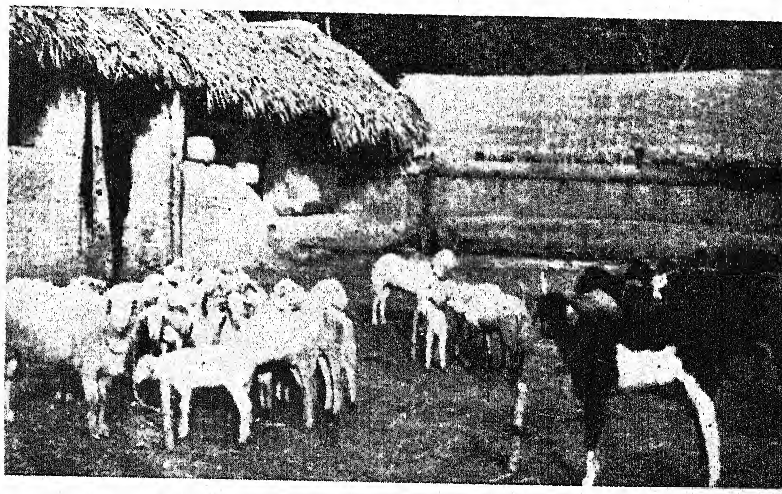


FIG. 2.
A sheep breeding unit headed by a Bikaneri ram and a Ganjam type goat breeding unit

FIG. 3.
Composts and manure pits with the veterinary stockman

PLATE 9

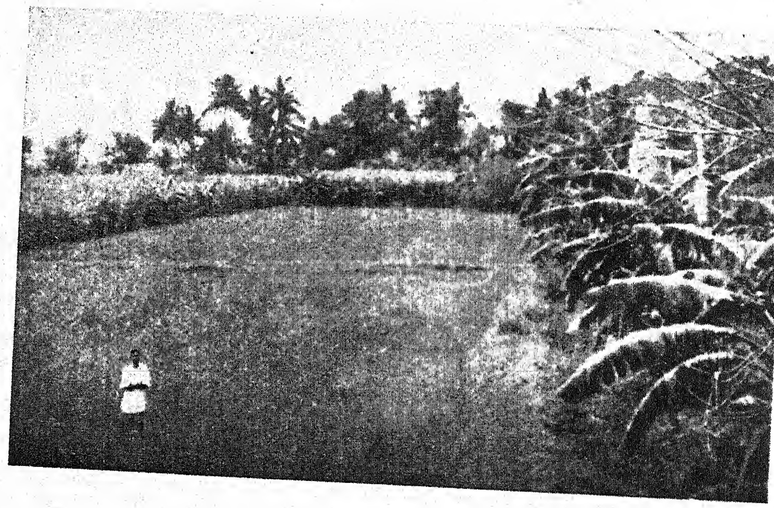


FIG. 4.
Paddy and sugarcane cultivation with plantains, cocoanut trees and elephant grass (with the Agricultural *Sardar*)

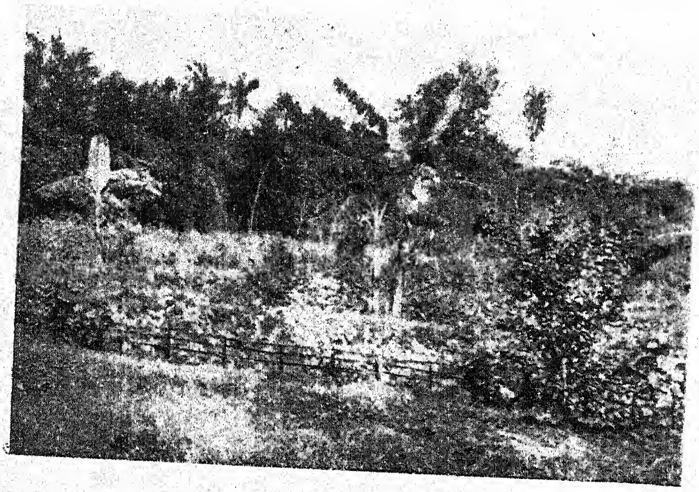


FIG. 5.
Cultivation of vegetables, fruits and fodder crops with a bit of pasture in front

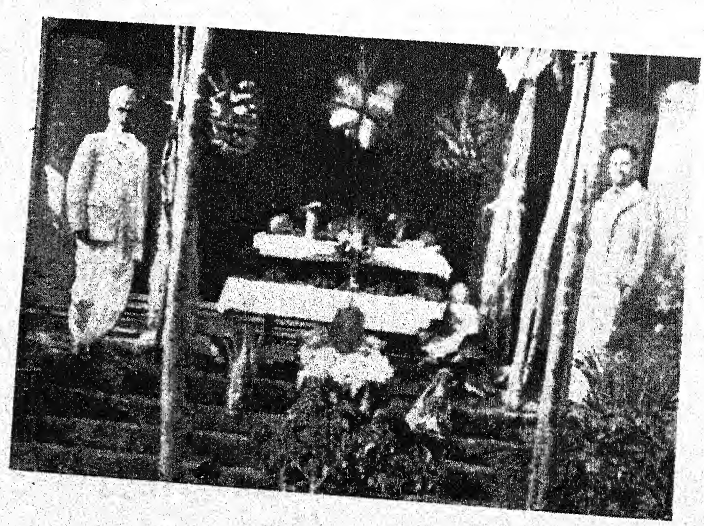


FIG. 6.
The proprietor (Rai Bahadur T. Venkatakrishniyya Pantulu) and his son with some of the farm produce, e.g. fruits, vegetables, jute, *gur*, wool, etc.

PLATE 10

TABLE II

Statement of income and expenditure for 1942-43

Serial No.	Name of the crop	Area (in acres)	Yield	Value	Expenditure	Net profit
				Rs. As. Ps.	Rs. As. Ps.	Rs. As. Ps.
1	Maize	1·0	—	124- 3-3	62-15-9	61- 3-6
2	Potal	0·30	—	51- 6-0	49- 1-3	2- 4-9
3	*Biri* and Cow-pea (fodder)	0·50	129 md.	12- 6-0	2- 8-3	9-13-9
4	Brinjal	0·35	—	75- 5-6	50- 0-0	25- 5-6
5	Soya Bean	0·55	10 md.	99- 3-0	10-13-9	88- 5-3
6	Sugarcane	2·30	140 md.	678- 0-3	190-11-0	487- 5-3
7	Paddy	8·50	220 md.	867- 9-0	195- 4-0	672- 5-0
8	Plantain	0·80	—	56- 9-3	33-10-9	22-14-6
9	*Biri* for seed	1·40	7 md. 20 sr.	26- 3-0	6- 4-6	19-14-6
10	*Ragi*	1·23	2 md. 16 sr.	11- 9-3	11- 3-6	0- 5-9
11	*Til*	1·20	1 md. 25 sr.	8- 7-3	5-13-6	2- 9-9
12	Potato	0·75	40 md.	312- 7-3	110- 6-0	202- 1-3
13	Tomato	0·25	—	56-14-3	13-13-3	43- 1-0
14	English vegetables	0·15	—	19- 5-3	8- 4-0	11- 1-3
15	*Mung*	4·25	22 md. 4 sr.	60- 8-0	37- 0-0	23- 8-0
16	Chillies	0·12	—	35- 3-9	8-13-9	26- 6-0
17	Radish	0·13	—	12-11-6	6-15-9	5-11-9
18	Wheat	0·50	3 md.	27- 9-0	19-14-9	7-10-3
					Total Rs.	1,711-15-0

TABLE III

Statement of income and expenditure for 1943-44

Serial No.	Name of the crop	Area (in acres)	Yield	Value	Expenditure	Net profit
				Rs. As. Ps.	Rs. As. Ps.	Rs. As. Ps.
1	Jute	0·56	7 md. 35 sr.	84- 0-0	17- 2-0	66-14-0
2	Plantain	0·30	—	64-11-6	23- 7-0	41- 4-6
3	Summer maize	0·30 }	—	50-13-3	25- 8-10½	25- 4-4½
4	*Kharif* maize	—	—	78-15-9	32- 2-0	46-13-9
5	*Rabi* maize	0·50	—	72- 2-1½	43-12-0	28- 6-1½
6	Tomato	0·34	—	121- 6-6	46- 3-0	75- 3-6
7	*Ragi*	1·25	16 md. 1 sr. 12 ch.	158- 0-0	18-10-0	139- 6-0
8	Soya Bean	0·5 }	—	11- 0-0	3- 5-0	7-11-0
9	Radish	—	—	12- 8-0	5- 6-0	7- 2-0
10	Peas and beans	0·5 }	—	26-14-6	6-14-0	20- 0-6
11	Wheat	—	—	50- 8-0	35- 6-0	15- 2-0
12	Potato	0·25	22 md. 23 sr. 4 ch.	153- 4-6	103- 3-0	50- 1-6
13	Onion	0·05	3 md. 17 sr.	15- 9-6	11- 7-0	4- 2-6
14	*Mung*	2·20	2 md. 5 sr.	102-13-8	25- 3-3	77-10-5
15	Sugarcane	2·80	160 md.	1,330- 0-0	970- 0-0	360- 0-0
16	Paddy	7·82	270 md.	1,552- 0-0	538- 0-0	1,014- 0-0
					Total Rs.	1,979- 2-2

NORTH-WEST FRONTIER PROVINCE

P. C. Raheja, M.Sc. (Agri.)
Sugarcane Specialist, North-West Frontier Province

NEW plans for the post-war industry of dehydration and sun-drying have tentatively been decided in advance of the season. This will enable the fruit-drying centre owners to lease the orchards at the proper time. The army requirements have been intimated to stand at a level of about 500 tons of processed and dehydrated deciduous fruits. The proportion for peaches, plums and pears will roughly be 2 : 1 : 1. A small quota for dehydrated apricots will also be allotted in case the import of dry apricots from Afghanistan is insufficient for the civil market. The Government has arranged to market another 200 tons of dry fruit of these varieties through well-known Calcutta firms dealing in these products. Large-scale catering establishments are the principal purchasers of these fruits and given the proper advertisement regarding instructions for the manner of their utilization, there is little doubt that the upper middle classes will in due course become the chief customers for these products. In open market some sales were effected last season and this is an encouraging sign for the future of this wartime industry. In the circumstances, the total production quota is likely to be fixed at 800 tons of all varieties of processed and dehydrated fruits. The Government is now taking steps through Marketing and Cooperative Departments to organize Cooperative Marketing Associations, through which the quotas for export of fresh fruit and that required for dehydrating centres will be fixed in advance. This will avoid unnecessary chaos and create confidence in the orchard owners, who usually do not dry the fruit themselves. This is expected to stabilize the industry.

Provincial sugarcane committee

Besides the United Provinces, it is the only other province which exports *gur* to the adjoining provinces of the Punjab, Sind and Baluchistan and the tribal territories adjacent to it. For the last three seasons the average export has been estimated at 95,000 tons of *gur*. There is one small sugar factory and another will start working in the 1946-47 sugar manufacturing season. This factory will have crushing capacity of 2,500 tons. Thus *gur* as an export commodity plays an important part in the economic prosperity of the province. The Provincial Government, therefore, on the recommendation of the Indian Central Sugarcane Committee constituted the Provincial Sugarcane Committee on 21 October 1945. Its first meeting is soon being arranged and agenda for this has already been circulated to its members. The members of the Committee include representatives of the sugar and *khandsari* industry, Cooperative Department and cane-growers. The Director of Agriculture, North-West Frontier Province, is the *ex-officio* Chairman of the Committee.

Cooperative marketing

The Hazara district is a very important potato tract of the province. Its produce is both utilized for seed and civil consumption. Unregulated marketing fetches low price to the growers. Possibilities of cooperative marketing were investigated some time ago by the Marketing Department and a scheme on the lines was submitted to the Provincial Government. The scheme is now functioning to regulate handling, grading, storage and transport.

Large quantities of wool are imported into the province from the adjacent tribal territories and States of Dir, Swat and Chitral. The district of Hazara and small States bordering on it produce wool of fine quality which is utilized for rug and shawl manufacture in Kashmir. During wartime the efforts were directed to utilize this wool for manufacture of blankets for the army. While efforts to stabilize that industry on sound lines continue, possibilities of cooperative marketing of the surplus wool, which at present is sold through middlemen to the woollen mills, are being investigated. The trade at present is unorganized and in the hands of small scale traders. In the post-war plan a scheme for cooperative marketing has been included on the lines of investigation already completed.

Weights and measures bill

There is a great variation in the weights and measures employed in the trade, so much so that a layman suffers from this handicap on several occasions. In Peshawar the weight of the local

maund ranges from 105 to 108 lb.; in Bannu it is weighted at 100 lb. and so on. The anomaly of the situation will be further realized from the fact that the local maund (108 lb.) which should weigh 1 md. and 12½ sr. when converted into standard weight weighs actually less. The articles weighed in standard seers and chhattaks are converted at 1 md. and 10 sr. Thus a common man sustains a loss conventionally, while paying at the standard weight rate, of 2½ seers per local maund. Similar anomalies exist in measures also. Draft bill for standardizing weights and measures is under the consideration of the Government to get rid of these trade anomalies.

Hailstorm damage

On 21 May 1945, a hailstorm following a windstorm did wide-spread damage to the crops in Bannu, Kohat and Kurram areas. The crops damaged were standing wheat in Kurram, threshed wheat and other cereals in Bannu and Kohat, last cutting of shaftal of which seed setting was in progress, sugarcane at tillering time and melons. In Kurram the apple crop was very seriously damaged by this hailstorm. Some damage to citrus was reported from Bannu district.

HOW TO USE AMMONIUM SULPHATE

AMMONIUM Sulphate is a very concentrated form of nitrogenous manure. It is readily soluble in water and induces immediate growth which is evident from dark green colour of plants after 6 to 7 days of application. Application of nitrogen (Ammonium Sulphate) favours leafy growth and this helps in the formation of more plant substances. Hence there is succulent growth with rich green foliage. It is, therefore, suitable for paddy, jute, maize, cabbage, cauliflower, lettuce, tomato and pumpkin. It should be applied at early stage of growth. Ammonium Sulphate should not be applied in excess. Excess application prolongs the vegetative growth and thereby delays maturity; in paddy straw lodges badly; potato produces more leaf and less tuber; resistance of plants to diseases is decreased. Ammonium Sulphate should not be mixed with wood or cow-dung ash, lime or with any other substance with alkaline reaction. Combination with any of these will liberate ammonia which would result in loss. Ammonium Sulphate, when purchased in bags, is found in lumps. These lumps should be broken down before use. Otherwise these lumps when applied will fall in one place and the concentration of the fertilizer will either kill the plant or will bring all the evil effects of excessive application. Ammonium Sulphate should not be applied when there is dew or rain. Otherwise it will fall on the leaves, will dissolve with the moisture on it and spread around. The leaves will thereby either rot or dry up. So it should be applied on a sunny day or when there is no rain between 10 A.M. to 4 P.M. It should be sprinkled over at a standing position so that it might fall on the soil. If some fertilizer falls on the leaves while spreading, the man applying the fertilizer should shake the plants either by hand or feet. For vegetables like cabbage, cauliflower, tomato and pumpkin—too much ammonium sulphate damages the tender roots and shoot of the plant, so it should never be applied near the base of the stem. After hoeing up the lines, a ring may be opened up at a distance of about three inches from the base of the stem. The fertilizer should be applied all round this ring and then should be covered up with earthing. For vegetables it is better to mix two parts of ammonium sulphate with one part of oil-cake. The lines of potato and maize plants should be hoed up first. While hoeing, the soil from one or one and a half inches away from the base of the plants should be brought away and piled up in the middle of the furrow. The excess of soil around the base of the plants should be removed by hand. Ammonium sulphate should be applied in the line so made and will be covered up by earthing. Sugarcane has a very good spreading fibrous root system. After hoeing up the line, ammonium sulphate may be spread at a distance of about six inches on either side of the row and then it should be covered up with earth.—*Dehat*, November 24, 1945.

AUSTRALIAN WOOL FOR INDIAN HAND-LOOMS

THE care which Australian sheep breeders and stud masters have lavished on the merino sheep has made Australia the greatest producer of fine wool in the world. In 1944, her 123,000,000 sheep produced 1,164,000,000 pounds of wool, valued at Rs. 80¼ crores.

Normally, about 80 per cent of Australia's flocks are merinos. The remainder are either British breeds, or cross breds used for meat production, mostly in the coastal districts.

But it is the merino which has made the greatest contribution to Australia's prosperity. The merino can live in any country, from the sub-tropical Kimberleys in the north of Western Australia, with its hot humid tropical climate, to Tasmania with its damp, cool English climate. The merino can live in any sort of country from semi-desert spinifex-covered hills, to lush clover pastures in the well-watered farming areas.

Over one-half of Australia consists of semi-desert pastoral country. A big station is a pastoral province. It is so big because it is so poor; that is, its carrying capacity is so small. In very poor country, a station may cover 5,000 square miles. Some paddocks will carry only one sheep for every 100 acres. A station in fair to good pastoral country may cover a million acres, carry a sheep to 20 acres. Good, well grassed pastoral country nearer the coast will carry a sheep to two acres.

Big stations are in the arid north-west of West Australia, or anywhere in inland Australia from 400 to 1,000 miles from the coast. They may be capitalized at anything from Rs. 5,35,000 to Rs. 26,75,000, the money being spent on fencing their million or more acres, in sinking wells and erecting windmills, in providing stock and transport, in erecting buildings and quarters for the small army of men—shearers, musteres, blacksmiths, mechanics, mill experts, boundary riders and horsebreakers—who work there in season or all the year.

Such stations grow good wool because the country is arid, the air clear and dry. Some years the Australian outback may get 20 in. of rain, then wait another five years before another 20 have fallen. The drier pastoral areas, which cover almost one half of Australia, have an annual average of less than ten inches.

Drought, after all, is only a question of degree in the back country. It is a harsh master, and has taught the pastoralists to keep Australia's fame for fine wool by a ceaseless culling of their flocks.

'If you want to grow the best merino wool in the world', wrote an old squatter in 1883, 'you must stop in this dry land, which is carefully cultivated by Nature with rotation of crops and allowed to lie fallow periodically. All life is a gamble, and I like to gamble with Nature, though I know that she always has an ace up her sleeve, and can ruin me when she likes'.

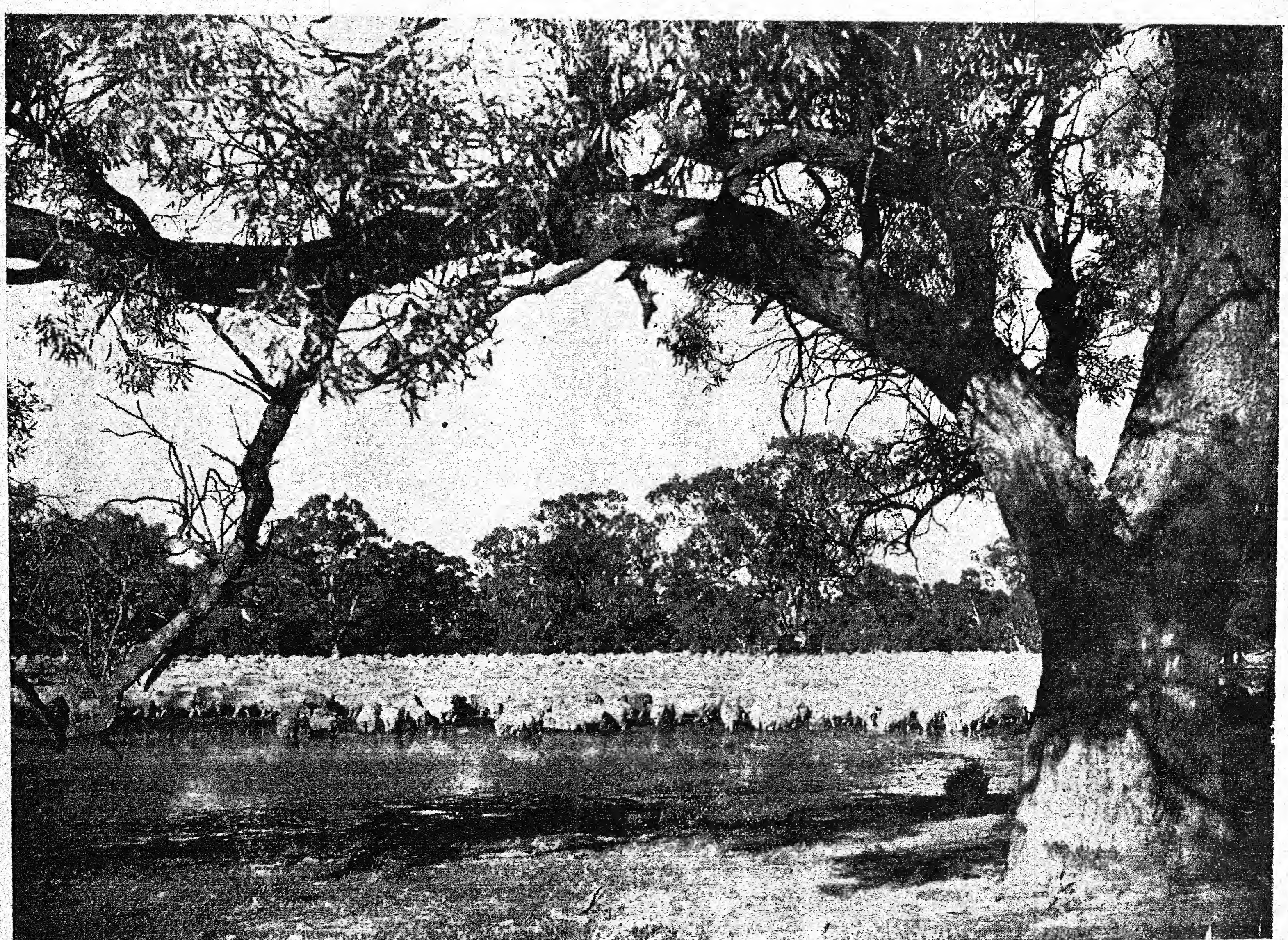
Suggestion for India

Wool's greatest advantage over its competitors is warmth. Countries like Europe, Asia Minor, the Soviet Union, much of India, China, Iran and South America, which have never imported much wool, offer an immense market for blankets and woollen clothing. Supplying such markets is another matter. Their buying power mostly is very low. Something will be done to provide cheaper wool by reducing present cost of manufacturing and marketing.

Another suggestion, made by Mr. J. P. Abbott, M.P., vice-President of the Australian Wool Board, is of interest, particularly in India.

'I believe that the development, in some industrially undeveloped countries, of village cooperatives, and cottage hand spinning and weaving, could so reduce the overhead costs between the raw product and the finished article, that the obstacle of low purchasing power in these countries could be solved to a considerable extent,' said Mr. Abbott. 'I suggest that the question of manufacturing cheap mass-produced hand looms and spinning wheels is one that the research institute might investigate, and governments might discuss'.

Another factor is competition from artificial fibres. Before the war, production of rayon had grown until it almost equalled the production of clothing wools. Its effect on the wool



AN AUSTRALIAN MERINO STUD STATION

A section of a mob of about 6,000 sheep being brought in from the back paddocks to the shearing shed

PLATE 11

consumption was slight, except in the underwear and hosiery markets. But staple fibre, produced from cellulose and cut into lengths, suited to wool-working machinery, has proved and will prove a more formidable competitor.

Wool is a protein fibre, and it now faces competition from fibres of animal and vegetable protein origin such as casein and soya-bean. Even plastics of a protein nature are on their way. Here the game will be played on wool's home grounds. But wool, which was not displaced by the meteoric rise of rayon, should be able to hold its place against the newcomers. It is largely a matter of price, and as prices of raw wool today represent only from 8 to 14 per cent of the retail prices of clothing, rationalization of manufacture and selling will increase wool's capacity to compete.

Woolgrowers take heart from the fact that the total production of cotton, greasy wool, silk and rayon from 1934 to 1938 increased by about 40 per cent, yet the world absorbed these quantities. Moreover some experts believe that the future of synthetics lies in blends with the great natural fibres, wool, cotton, and silk. Mr. August Hafner, of Hafner Associates Inc., believes that 'wool, the oldest of the fibres known to man, still has advantages that no other fibres can duplicate, as have cotton and silk. These three elementary fibres known for thousands of years will be used as much as ever but new beauty can be added to them with plastic yarns'.

Research, during the post-war years, has also increased wool's capacity to compete. Commercial processes have been developed to make wool shrink-proof, moth-proof and tickle-proof. New woollen fabrics are being developed which it is stated have a sheen that will rival the finest silks and satins. Other research workers are trying to achieve the opposite; are trying to shine-proof wools for dull-finished materials.

Wool is even preparing to throw its hat in the fur ring. Today, sheepskins, can be treated and dyed, so that they assume an authentic fur-like effect. Such 'fur' coats can be produced much cheaper than the fur coats of fashion.

Something, too, has been done to reduce wool production costs. In 1937, the International Wool Secretariat, with headquarters in London, representing the woolgrowers of Australia, New Zealand and South Africa, was formed to carry out research on behalf of the industry. It has made valuable discoveries in dealing with footrot, blowfly strike and other parasites, internal and external. Now, it is studying nutrition. None can say for certain whether Australia can carry more sheep than she does today, but there is no doubt that she can carry better sheep. Since the eighties, improved breeding and improved feeding has increased the average cut from five pounds per head to nine pounds per head. Dr Clunies Ross, Professor of Veterinary Science, University of Sydney contends that the great bulk of Australian sheep could produce 50 per cent more wool if adequately fed and that, as the capacity of the sheep to grow wool is determined basically by heredity, better breeding methods, such as progeny testing of rams, and perhaps artificial insemination, will still further increase the average wool yield.—*Australian Agricultural News-letter*, Release No. AGN/110.

FOREST POLICY

FORESTRY is of importance to the economic well-being of any country. It is of especial value to agricultural countries. By the very nature of the case it is a big institution which can only be tackled with the resources of the State and private enterprise has very little place in it. Enormous amounts of capital are locked up in it for often periods of more than a man's life. Often indeed no return can be expected from capital invested for 50 to 150 years, for forestry grows a crop taking normally anything from 50 to 150 years to mature. A private investor is interested in realizing the maximum profits and such a course would in the case of forestry destroy the forest itself. This has been the case with the vast majority of forests in every country in Europe and there has been almost a complete breakdown of private forest ownership in the United States of America. In India also many individual trading corporations have destroyed or ruined several valuable forests.

Forests fulfil a number of demands among which demands of the agriculturists should be given prior consideration. There is first the demand for fuel from the general consumer. There is also the demand for forest timber of various kinds for agricultural implements, railway sleepers, buildings, furniture, etc. The availability of these materials is to be mainly conditioned by the cost of conversion and transport. Nearer access to forest produce in the neighbourhood is, therefore, a necessary condition for the satisfactions of the wants of the villagers for forest produce. Hence the importance of having forests scattered fairly uniformly over the country. The distribution of forests in British India is not uniform. About 20 per cent of British India is covered with forest land, both Government and private, of which the merchantable class forms 12 per cent. But most of the private forests are mismanaged and cannot, therefore, be correctly regarded as forests. Further during the war years private forests have been overfelled almost to the point of extinction. Even normally the percentage of forest land in India is only about 14 per cent of which only 9·3 per cent is merchantable. While it is not possible to suggest the minimum percentage that is necessary for the well-being of the country, we should however try to undertake afforestation to such an extent as to secure at least the average percentage of forest land in other countries. European countries for example have on the average about 26 per cent of forest land. Countries having a less percentage are heavy importers of timber.

Certain principles govern the forest policy of the Government of India evolved over half a century ago. The Government forests are classified under four heads : (a) Those necessary on climatic or physical grounds ; (b) timber forests ; (c) minor forests and (d) pasture forests. The forests belonging to the first class are of prime importance for agriculture and life and are called protection forests. Situated in hilly country and often at head waters of rivers, they afford special security against floods, soil erosion and dessication. Of special significance to agriculture is soil erosion due to heavy floods. "The clogging of the natural pores of the earth from sediment washed down by rain eventually interferes with seepage and percolation. The actual run-off is thus increased and the silt and pebble-laden water running over the surface acts rather like a file in rasping away more soil. Not only is the surface rubbed away, but tiny gullies called 'figure gullies' are formed and a thin skin of land is eventually stripped off. At the same time, soluble chemicals and micro-organisms necessary for plant growth are lost." The worst stage is reached when clefts cutting through the sub-soil are formed so that greater erosion is made possible. The net result of these floods and subsequent erosion is that several acres of good arable lands are made unproductive. Floods and soil erosion are the immediate danger facing land especially in the hilly tracts. But large tracts along the Himalayas especially and many other hilly parts are barren of growth. Nor do we fail to come across several areas in these tracts where unlimited grazing is allowed or which are burnt yearly. This has been mainly due to mismanagement of

these lands and the only solution would be to class them all as protection forests and undertake afforestation on a fairly large scale. We can well afford to afforest many of the lands over the hill slopes which are now used as pasture lands. Even in the minor forests especially in the Central Provinces, the United Provinces and also in certain Panchayat forests of Madras overgrazing has led to serious run-off and erosion.

While excessive grazing rights and burning of the forest soil have lessened the capacity of the land to resist soil erosion, often a single infrequent but heavy rainfall by cutting out fresh gullies leaves the problem of controlling erosion beyond control. This is to be specially realized in our country for the normal rainfall is not evenly distributed throughout the year but falls heavily in the few monsoon months resulting in enormous loss of life, property and crops. The present policy completely lacks any principle of allocation of land to be kept as forests for the preservation of the general climatic and physical conditions of the country. Nor is there any principle laid down requiring a certain percentage of land area to be kept as the minimum necessary forests or to be created. These are serious lacunae in the Government's policy and need to be filled with the least delay.

The policy outlined with regard to the management of the timber forests has been the principle of sustained yield. But the wartime overfellings have upset the normal course. It is calculated that up to the end of the financial year, 1943, an excess felling of 162 per cent for all India over the normal figure has been done. This means then 1½ years advance felling and is really an 'over draft' on the forest capital. Most unfortunately these fellings would be on the best trees in the interests of war effort and in certain areas nearly 15 to 20 years will have to be taken to bring the position back to normal. The problem will be serious in the United Provinces and the Central Provinces which are the worst sufferers in this respect.

Normally imports of timber into India are only about 185,000 tons of which a considerable portion is teak wood from Burma which is eventually expected to be replaced by development of teak plantations in the reserved forests of India. If a careful policy is to be adopted in the future to recoup the forest wealth of India lost during the war years we will have to import more or to develop forests. The war experience has also developed new wants for several kinds of trees and other resources which have not so far been used and they may well stay. Incidentally, this development may well make it possible for the Government to undertake a better enumeration of the forest resources than has hitherto been possible.

These reinforce the necessity for an afforestation policy. The Agricultural Statistics of India, 1937-38, reveal about 144,000 square miles of British India as 'cultivable waste' and another 144,000 as 'not available for cultivation'. It is quite probable that about half these areas would be able to grow forest sufficiently good for providing timber and fuel for the ordinary village consumer. There are also the areas classified as scrub forests which if properly developed under the Forest Department can well afford to meet the ordinary requirements of the villager for fuel. Some of the worst placed provinces with regard to fuel supply have vast areas belonging to the aforesaid classification and proper management and development of them will go a long way to mitigate the acute problem of supplying the agricultural villager with necessary fuel and timber. Special attention needs to be paid to development of forests in the north-west portions of India where rainfall is meagre. With a careful irrigation for the first two or three years it is possible to grow plants and trees of a sort that will be able to meet the demands for fuel. This is also necessary to put a break to the tendency to extend the desert conditions towards the east.

The supply of fuel is closely connected with the problem of stopping the enormous waste of good manure being burnt in the form of cowdung. It is to be realized these burnings are resorted to only because of the non-availability of sufficient fuel and not because the villager is not in the know of things with regard to the value of cowdung as fuel.—Reproduced from *Eastern Economist*, 7 September, 1945.

The Month's Clip

FOREST POLICY

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A NOTE ON DOCKING IN LAMBS

MOST practical men like to think they cut the tail through a joint rather than sever one of the small bones of the tail. Observations made in many lamb marking camps indicate that very few operators 'strike the joint' in more than about 30 per cent of tails. Recent research work carried out in Queensland by the Council for Scientific and Industrial Research has shown that, although cutting through a joint makes the operation easier, it is unimportant from the point of view of the rapidity with which the tailing wounds heal.

Covering the stump of the docked tail

One of the most important practical points is to cut the skin on the underside of the tail longer than that on the upper or woolly surface. Such a practice draws the skin from the under surface round over the end of the stump, and the scar develops towards the back of the tail. In this way the bare unwoolled skin from the underside of the tail grows over the cut end and the woolly surface is not brought opposite the anus and vulva, where it could come in contact with moisture, which would eventually lead to tail strike.

The length of the tail

Recent investigations carried out by Council for Scientific and Industrial Research have shown that the length at which the lamb's tail is cut is of paramount importance for two reasons:

(1) The rapidity with which the wounds heal.

(2) The subsequent protection of the sheep against crutch strike.

If the tail of the average lamb is cut so that it is just long enough to come down to cover the woolless skin around the vulva and anus, i.e. to cover the 'bare area', it will be cut at the optimum length from both points of view.

The docking wounds on tail stumps cut shorter than this are readily soiled with excreta and healing is delayed as the result of the consequent infection, while tails cut at the recommended length heal most rapidly and they also give the maximum protection from fly strike, especially if combined with the Mules operation, for the rest of the sheep's life. Tails cut longer than is recommended will be a definite source of danger from both 'dagginess' and tail strike.

The operation of docking

One easy way to get the end result described above is to perform the operation as follows:

(1) Hold the tail in the left hand and decide on the correct length at which it should be cut. Place the knife blade flat on the under surface of the tail and a little further down towards the tip.

(2) Press the knife on to the tail and move it up towards the lamb's body until the point where the tail is to be served is reached. In this way the skin is puckered behind the knife.

(3) Bend the tail over the knife blade by moving the left hand in towards the scrotum.

(4) Cut the tail, directing the knife towards the operator's abdomen.

Take care to pivot the right elbow on the right hip-bone during the cutting operation. This will remove any possibility of the operator stabbing himself. Abstracted from 'Correct Methods in Lamb Marking' by G. R. Moule in *Queensland Agricultural Journal*, September, 1945.

WE HATE TO BELIEVE IT, BUT——

DEFINITION—Pasteurized milk—milk from cows on pasture.

DEFINITION—Gentleman farmer—A farmer who milks his cows with his gloves on.

(*Cambridge University Agricultural Society Magazine*, 1932).

New Books and Reviews

FARM ENGINEERING AND MANAGEMENT

THE Department of Agriculture recently received from the United States of America a series of twelve admirably produced booklets on Farm Engineering and Management. They comprise an entire Course of Correspondence instructions on all aspects of Farm Engineering and Management and have been prepared by the LaSalle Extension University, Chicago, for the National Farm Youth Foundation, sponsored by the Ferguson-Sherman Manufacturing Corporation, with the cooperation of Mr. Henry Ford, Founder and Mr. Edsel Ford, President of the Ford Motor Company. The Course is planned to prepare the American Farm Boy for a career of farming either as owner or Manager. It presupposes the attainment of an elementary educational standard normally within the reach of American boys. It emphasizes the dignity of farming as a profession, its importance to National Economy and the necessity for organized efficiency in farming for the well-being of the individual farmer and of the community. It seeks to instil a sense of pride in the profession of farming and to encourage the American boy to choose farming as a profession and get an honourable and good living out of it. The method of presentation is simple and the approach is direct and personal. Different aspects of the various operations constituting the business of farming and the application of engineering and management technique are discussed in simple language. The emphasis is always on principles and methods of approach to problems rather than on specific answers to problems. By this means technicality is avoided but the student is trained to meet and solve problems as they arise.

For obvious reasons, the Course as it stands will be of no use to the Indian Farm boy. He is not equipped to acquire instruction by Correspondence. His instruction should be by example and precept. Such utility the Course possesses will be for the educated personnel in Agricultural Departments. To such, even a cursory perusal of the booklets indicates, the Course can be of immense assistance.

In this country, the teachers and students of Agriculture Colleges are likely to derive the greatest benefit from the booklets because of the considerable amount of basic information which these contain on various aspects of agriculture. These booklets are likely to be of greater value from the point of view of agricultural economics rather than of pure agriculture and can inspire the teachers with ideas and may give them practical guidance for essential matters connected with the business side of farming. The staff of Agricultural Departments as well, who have long passed out of colleges, may read this with much profit to themselves and the District Development Officers may get, by a thorough study, much useful guidance in many spheres of their activities.

Benefit may be obtained in another direction also. The booklets are interspersed with excellent photographs, diagrams and charts and the method of presentation compels attention. A perusal of these booklets will be helpful to our Agricultural Officers in designing and producing educative posters, booklets, etc. for the benefit of Indian cultivator in an attractive manner.

For these reasons it has been thought worthwhile to publish a short review of this Course. This follows. Each division of the subject is called an 'Assignment' and the Assignments are dealt with in the order they are presented in the Course. Wherever ideas for adaptation for Indian use are apparent these have been added after the reviews, in the form of short notes. Only the most obvious items for adaptation have been presented. Actual perusal of the original booklets would produce scores of other ideas.

Interested Officers, who require copies, may get in touch with the Deputy Agricultural Production Adviser (Implements), Department of Agriculture, New Delhi, who is investigating the availability and cost of further copies of this Course.

Assignment one. The business of farming

Farming as a Career is presented as the best of professions. The advantages of farm life,

the sense of independence it imparts are all played up.

The student is given general hints on how to organize his spare time for study. The entire Course is explained and the basic principles of good farming are laid down. Questions such as 'What is Management', 'How are the fundamental principles of Management applied to farming' are answered. The method of solving problems by analysis to fundamentals is imparted. Five standard problems confronting the Manager—whether of a farm or a factory—are stated and analysed as follows:

1. *Production problem*—Analysed into:
   (a) Gaining an increase in volume.
   (b) Securing improved quality.
   (c) Reducing cost.
2. *Marketing problem*—Analysed into:
   (a) Producing to meet market demand.
   (b) Gauging price trends.
   (c) Selling in the best market.
   (d) Getting the best obtainable price.
3. *Labour problem*—Analysed into:
   (a) Anticipating needs for labour.
   (b) Securing right kind of labour.
   (c) Supervision.
   (d) Controlling labour costs.
4. *Finance problem*—Analysed into:
   (a) Anticipating needs for cash.
   (b) Providing working capital.
   (c) Protecting credit.
5. *Record keeping problem*—Analysed into:
   (a) Deciding what records are necessary.
   (b) Keeping records.
   (c) Using records for control of operations.

Photographs are given in sets—setting off poorly managed farms with well managed ones.

Assignment two. Managing the farm plant and equipment

The effect of size and layout on farm economy is discussed and excellent diagrams provided showing how layouts can be planned for best results from points of view of economy, soil conservation, etc. The problems involved in fencing and roads on farms are discussed. The arrangement and equipment of farm buildings are explained and farm modernization is touched upon.

In India the conditions governing shapes and sizes of fields are entirely different from those obtained in the United States of America and to this extent the conclusions drawn regarding layout may not be applicable in this country. The emphasis on layouts to prevent soil erosion is however worth noting. Seven methods of soil erosion control are listed. These are:

(a) Contour strip cropping.
(b) Contour buffer strips.
(c) Grass water-ways.
(d) Terracing.
(e) Tilling on contour.
(f) Permanent grass.
(g) Forests.

It is emphasized that the most economic method in the long run should be considered and adopted.

(The diagrams illustrating advantages of proper layout of farms may be used as models for propaganda posters for consolidation of holdings into economical units).

Assignment three. Soil and crop management

The basic facts about soils, factors controlling soil fertility, maintenance of fertility and erosion control, place of tillage in soil and crop management, crop selection and insect, weeds and pests control are the subjects dealt with in this Assignment. A slogan reads 'A mark of a good farm Manager is that he farms on good soil. His soil is good either naturally, or he makes it good'. Structure of soils, the various constituents that go into the making of good soils, measures to increase soil fertility, etc. are discussed in detail. Tests for soil fertility, use and misuse of manures and fertilizers are discussed. The problem of erosion control with particular reference to crop selection for this purpose are explained. The primary purposes and benefits of tillage are summarized as follows:

1. Good tillage produces a favourable tilth or soil structure. This aids the development of strong root structures and increases the feeding area of the plants.
2. Good tillage helps the incorporation of organic matter with the soil, hastens decomposition, and liberates nitrogen.
3. Good tillage improves aeration of the soil. This results in increased bacterial and chemical actions which increase the amount of available plant food.
4. Good tillage kills weeds. Destruction of weeds eliminates competition for space and conserves plant food and water for the cultivated crops.
5. Good tillage conserves moisture. It does this by aiding absorption of rainfall and lessening evaporation.
6. Good tillage aids in the control of plant diseases and insect pests.

7. Good tillage aids in erosion control by putting the soil in condition to absorb rainfall more readily, by incorporating more organic matter, and by checking the flow of water by means of contour tillage. Where wind erosion is a factor, implements are used which till the soil without unduly pulverizing it, leaving it in clods and ridges designed to trap drifting soil.

The importance and advantages of proper crop rotations are also summarized as follows:

1. They provide for effective soil maintenance.
2. Some crops follow others with the minimum of cost for seedbed preparation.
3. Rotations reduce costs by distributing the demand for labour, power, and equipment through the year.
4. They tend to reduce weather and market risks.
5. They give a well-balanced supply of livestock feeds.
6. They provide the maximum desirable acreage for crops which normally yield maximum profits.
7. They discourage weeds, insects, and soil-borne crop diseases.

The best planned rotations are stated to be found in well-balanced successions of the following three kinds of crops:

1. Cultivated crops.
2. Small grains.
3. Hay or pasture.

A section is devoted to the management of seeds, insects and weeds. The necessity for good seed is emphasized. Methods of insect control practice in U.S.A. are also outlined.

(This Assignment contains diagrams emphasizing advantages accruing from the use of fertilizers. Similar diagrams are already available for Indian conditions for many crops, e.g. the wood-cut illustrations in Masani's *Our India*. It may be advantageous if all crops and conditions are dealt with in similar posters.)

Assignment four. **Profitable management of farm operations**

The most interesting portions of this Assignment are the summaries of physical and economic factors contributing to low cost production of crops and livestock. On the basis of these summaries students are advised to plan their crops and livestock programmes. The economics of production are dealt with in detail. Methods of solving problems, such as figuring out whether, on the basis of price obtaining for beef, feeding up of cattle would be more profitable than selling off immediately, are discussed. The necessity for balanced farming for maximum profits is emphasized.

(This Assignment may be studied with profit for the preparation of standard conditions charts by areas and crops to be used as standards of measurements in organizing improvement and drawing up basic targets to be aimed at. If these are made available to the cultivator he will then have means of seeing to himself how successful he is in his efforts to increase production.)

Assignment five. **Handling labour on the farm**

The main point made in this Assignment is the principle that full utilization of labour is essential to low cost production. To achieve a steady utilization of labour and avoid peaks of activity and periods of complete idleness, the preparation of labour calendars for various products of the farm is advocated. These calendars would show which periods would require most labour for which crop and on the basis of these calendars, crops and livestock programmes can be drawn up, which will, while providing adequate employment for the labour force throughout the year, prevent undue strain during any period.

Qualities required of farm labour are discussed. Importance of keeping labour happy is emphasized.

(The preparation of labour calendars by crops and areas is suggested. Large posters showing waste of labour during the year would bring home to the cultivator the importance of crop rotation and subsidiary industry to ensure profitable employment throughout the year.)

Assignment six. **Profitable use of modern farm machinery**

The use of machinery is justified by comparative tables of cost of production for wheat for the years 1830, 1896 and 1930. According to the figures provided in 1830, it took 57·7 man hours, in 1896 8·8 man hours and in 1930 3·3 man hours for the major operations in the production of an acre of wheat. It is pointed out that in Kansas, if machinery is not used, it would probably require every adult member of the population to be in the field to produce as much grain as is now done.

Types of machinery required are classified. The importance of choosing correct machines for local conditions is emphasized. Hours of man labour for various size farms using horses only, tractors

supplementing horses and tractors only are worked out. Methods of determining comparative costs are laid down. A section is devoted to the proper care and maintenance of farm machinery.

(This Assignment provides the basis for educative literature emphasizing the advantages of using improved types of implements, for utilization of power for pumping, feed preparation, etc.)

Assignment seven. **Farm power and tractor farming**

While the previous Assignment dwelt on the comparative advantages of mechanical farming as opposed to animal power, the present assignment seeks to discuss the advantages of using tractors on farms and also of harnessing wind power and utilization of electricity on farms. The factors effecting choice of size of power units are considered. A special section deals with the care and maintenance of tractors.

(This Assignment could be studied for the preparation of Tables of comparative costs, mainly for the benefit of the larger zamindars, to enable them to realize the advantages of mechanization on large estates.)

Assignment eight. **Managing the money problem**

This Assignment seeks to lay down general principles for arriving at the best proportions of capital and working expenses for the greatest return. Credit facilities and systems obtaining in the United States of America are explained and simple legal documents reproduced. The type of loans, the periods of amortization, etc. in relation to the farmer's repayment capacity, standing credit, etc. are discussed. A section deals with the importance of subsidiary cottage industry in getting maximum value for money.

Assignment nine. **Farm records as aids to profitable management**

This Assignment deals with the purpose of farm records, systems of record-keeping and how records can be made to give information for controlling farm operations. A typical set of accounts books for use on farms is reproduced. Methods of arriving at decisions on figures thrown up by accounts are discussed.

Assignment ten. **Profitable marketing of farm products**

This Assignment deals with the economics of marketing and emphasizes the necessity for gearing production to marketing. It also emphasizes the importance of quality as a marketing factor.

Instructions are given on judging the best time to market, choosing the best market outlet and how to reduce the risks of marketing. Special attention is paid to marketing of specialities, to advertising, etc.

Assignment eleven. **Legal and economic factors in farm management**

The law governing land in the United States, the laws of contract purchase and sale, negotiable instruments, tenancy agreements, rights and reponsibilities of ownership, etc. are discussed in this Assignment. A section also deals with sources of legal and economic information, available to the American farmer.

Assignment twelve. **Salesmanship and personal success**

This Assignment deals with the importance of salesmanship in being a successful farmer or farm manager.—A.G.M.

THE INDIAN SUGAR INDUSTRY

Edited By M. P. Gandhi (Gandhi & Co. Jan Mansion, Sir Pheroze Shah Mehta Road, Bomby, pp. 90, Rs. 6/8.)

THE 1944 annual is in form and substance, closely similar to the earlier issues. The most valuable part of the annual is undoubtedly the series of statistical tables in the section 'The Sugar Industry at a Glance'. The tables are all the more useful on account of the suspension of a number of official publications on sugar.

Sugar control is reviewed in some detail, and has received considerable praise. The industry, which was first critical of control has, now become reconciled to it. Although the war has ended, there has, so far, been no demand for the removal of sugar control. The industrialists no longer consider it an unmitigated evil, but are willing to concede some good points to it. They admit that it helped them in moving their stocks to the markets during a period of acute shortage of transport facilities of all kinds.

The remedies suggested for the ills of the industry are not novel. Emphasis is laid on the need to reduce the cost of cane, by agricultural improvements. This is, however, easier

said than done. The practical difficulties are formidable, but are being tackled by the cane development departments in the United Provinces and Bihar to the limit of their resources. —R.C.S.

NEW BOOKS RECEIVED

1. *Hints on Saving Stored Grains from Pests* by B. L. Chaudhuri, B.Sc. (Agri.), (Aryan Road, Jail Road, Nagpur, C.P., pp. 36, Rs. 1-4).

2. *A Plan for Developing Fisheries in India* edited by E. V. S. Maniam, M.A., D.Econ. (Patt and Co., P.O. Box No. 45, Cawnpore, pp. 17).

3. *What Next? Can India be United?* (Bureau of Research and Publications, Tata Institute of Social Science, Bombay, pp. 31, As. 12).

4. *History is not made this way* (Renaissance Publishers, 30 Faiz Bazar, Delhi, pp. 45, As. 8).

REVIEW

(Alternate Husbandry. I.A.B. Joint Publication No. 6. Published by the Imperial Bureaux of Pastures and Forage Crops (Aberystwyth) and Animal Health (Weybridge), May, 1944. (Imperial Agricultural Bureaux, Central Sales Branch, Agricultural Research Buildings, Penglais, Aberystwyth, price 5s.)

THIS publication provides an eminently readable, if in parts somewhat elementary, account of the factors involved in alternate husbandry. The nine sections are : Trends in different countries and regions (R.O. Whyte) ; The influence of herbage rotations on the soil (G. V. Jacks) ; The roots of herbage plants (R. O. Whyte) ; Types of leys and their component species (R.O. Whyte) ; The animal crop in relation to alternate husbandry (J. E. Nichols) ; Fertility types, production and requirements (R. O. Whyte) ; Alternate husbandry and current agricultural problems (R. O. Whyte) ; Alternate husbandry and animal diseases (E. L. Taylor) ; and Economic factors in changes from other agricultural and pastoral systems to alternate husbandry (A. W. Ashby and W. J. Thomas). Most sections have excellent bibliographies.

Space does not permit of a detailed review of the work as a whole, but it may be said that veterinarians from certain parts of Great Britain, and from many parts of the Empire, will find in it much of direct practical value to their work. It is obvious that the animal husbandry aspects, particularly in ley farming, are at present but little understood. In the chapter on the animal crop, Dr Nichols—who unfortunately cites no references—is deliberately cautious in interpreting such data as are available. The sub-section in his contribution entitled 'Animal physiological factors in husbandry' is limited to such considerations as size of the animal, although it contains a brief note on the system of continuous cross-breeding and on the contrasting system recently adopted in certain sub-tropical areas, whereby an attempt is made to construct a new type or breed of better adaptation or performance than existing types by combining physiological traits of performance, growth, hardiness, and disease resistance from two or more breed origins.

Dr Taylor's contribution deals mainly with parasitological implications, and many of his points will be famliar to those who have read his contributions to the Veterinary Record. He omits consideration of the important nutritional and metabolic disorders of grazing animals—except for calorific deficiency—but deals briefly with the little that is known relating to the influence of alternate husbandry upon bacterial and virus diseases. A strange omission, in view of the fact that he discusses the viability of *Mycobacterium johnei* excreted in the faeces, is any reference to the work at Shinfield on the survivability of *Mycobacterium tuberculosis* in cow dung.

Veterinary students will find the publication of value for their courses in Animal Husbandry, Part II, and in Parasitology.—*The Veterinary Record*, January 13, 1945.

From All Quarters

NEED FOR STORAGE

'IF in Great Britain, where the people are far better fed than in India, the Government has assumed a direct responsibility for food for the people, the necessity for assumption of a similar responsibility in India must be obvious' stated Mr. B. R. Sen, Director General Food, inaugurating at Delhi an instructional course on storage for officers from provinces and States. 'There can be no question of our going back to the peace-time economy of pre-war days, to leave supply of foodgrains in all its aspects to private enterprise'.

'In Great Britain they have decided', he said, 'that the Ministry of Food set up at the outbreak of the war to deal with food problems under war-time conditions will become a permanent department of government'.

Explaining the Government's five-fold programme of storage, he stated that it was first, to increase, with all possible speed, both temporary and permanent storage accommodation under the control of the Government, in markets, at railheads and in consuming centres.

Secondly, to establish reserves in producing areas, for long storage, e.g. of paddy or wheat in bulk, which will serve, during the period of emergency, as buffer stocks.

Thirdly, to set up officially controlled inspection agencies, and analysis laboratories as a means of establishing and enforcing high quality standards for food distributed to the people.

Fourthly, to encourage by all possible means, such as assistance with material and advice, the construction by private interests of good foodgrain storage, whether for commercial, agricultural or domestic purposes.

Fifthly, to inculcate as widely as possible in all members of the public who grow, handle or consume food, the main principles of hygienic conservation of foodgrains and with that view, to run courses at the Centre for the training of officers nominated by provincial and State Governments.

'After the fall of Burma', he continued, 'the food situation in India compelled the Government to take over the responsibility of procurement, movement and storage through its own official machinery. With increasing difficulties in railway and other transport and shortage of accommodation and building materials due to war-time conditions, the losses in foodgrains naturally became even greater under official management which was unaccustomed to trading practices and was lacking in experience of the grain trade. In the circumstances, the problem of preservation of grains by good storage assumed special importance'.

'While some progress has already been made', said Mr. Sen, 'particularly in the construction of storage by the Central and Provincial Governments, the necessity of a wide and continuous campaign, using all methods of publicity, the precept and example of leading citizens and the initiative of Government Departments, to increase the conservation of foodgrains and to improve their quality remains as urgent as ever'.

'With the end of the war', continued Mr. Sen, 'the whole problem of food control must require a full review. The Government of India has already stated that food controls in their present form will be gradually relaxed on a coordinated basis having reference to the prevailing conditions regarding food supply. The Famine Inquiry Commission have dealt with this point in their Final Report. They have also pointed out that Governments in India have within the last 100 years contented themselves with the duty of preventing widespread deaths from famine but had not assumed the obligation to provide enough food for all. This responsibility, according to the Commission, the Government in India must now recognize as with the rapid growth of population in India a policy of *laissez faire* in the matter would end in catastrophe'.

'What form peace-time controls will take, I am not in a position to say. But I am quite clear in my own mind that an intergral part of post-war food administration in India must be provision at suitable places throughout the country of Government grain storages scientifically constructed and under proper technical supervision. Such storages could be used to maintain buffer stocks to meet local shortages—and it must be remembered that the food position in India is now so precariously balanced that a failure of the monsoon in any considerable area in any year creates conditions of scarcity

and famine—to support the minimum prices guaranteed to producers, to provide a means of expanding agricultural credit and generally to help in preventing the appalling wastage which has been a feature in food economy in India in the past. In the circumstances, the necessity of continuing of instructional courses such as the present one which will help to spread the knowledge and practice of hygienic conservation of foodgrains must be clear'.—*B.P.I. Press Note.*

FIGHTER ON THE FOOD FRONT

TWENTY years back transplantation of paddy by raising seedlings in seed-beds was entirely absent. Seeds were sown broadcast at the rate of 25 Madras measures (75 lb.) per acre. A month after planting fields used to become weedy with gaps in several places necessitating frequent weeding and filling-in of gaps. Tillering was poor; crops resulted in chaffy grains; yields were poor amounting to 10 to 12 bags per acre. In addition the cultivation of paddy in those days was expensive.

It was about the year 1925 that raising of paddy nurseries and transplantation were advocated by the then local agricultural demonstrator Sri. R. Swami Rao. Ten Madras measures of paddy raised on a seed-bed of 10 cents was advocated to be sufficient to plant an acre. I tried this method side by side with the local method of raising by broadcast. Both the plots received the same quantity of manures. Not long after sowing in the broadcast crop, weeding was done with the help of about 18 coolies per acre and a second weeding necessitated the engagement of 15 coolies per acre. In the case of transplanted field, 15 coolies were engaged for transplantation and 3 to 4 coolies were enough to weed this field. The transplanted crop came up well, had profuse tillering and unlike the broadcast crop did not lodge. The yield from the transplanted crop was four bags more than that sown by broadcast. Thus, by adopting the departmental method of raising paddy by transplantation, I was able not only to increase the acre yields of paddy but also reduce the seed-rate and cultivation expenses to a considerable extent. Now, as a result of Departmental activity, transplantation of paddy has become a well-established practice in my village and round about.

Another improvement recommended by the Department during the past two years is the growing of improved varieties. The variety No. 10998 has become popular in our village. This is resistant to the blast disease of paddy even though sown late in season whereas the local *Molagolukulu* is highly susceptible under such conditions. The straw of the departmental variety does not shed seed. Another variety No. 2202 (improved *Molagolukulu*, was introduced recently. Its good qualities are: (a) high blast resistance, (b) soft straw and palatability to cattle, (c) no lodging or shedding, (d) shiny and attractive grain, (e) higher yield (3 to 4 bags more) than the local *Molagolukulu* or Strain 10998. It is a matter of great satisfaction to the ryots of Chennur and round about, that year after year they are deriving a good amount of benefit from the improved varieties of paddy distributed by the Agricultural Department.

Sugarcane: Forty years back, red and white sugarcane occupied fields in my village. The cultivation was also on primitive lines. The ploughing with country plough twice with 16 to 20 cart loads of cattle manure per acre and the planting $1\frac{1}{2}$ ft. apart of 15,000 to 18,000 setts, were the common practices. The canes were thin. The juice was boiled in turmeric-boiling pans, and fuel worth Rs. 130 to Rs. 140 per acre was used. With all this, the acre yield amounted to only 200 to 250 md. of jaggery. In those days the cultivation of sugarcane was so discouraging that for some years it was entirely given up by ryots in our locality. It is in the year 1938 that we were advised to follow improved system of sugarcane cultivation by the present District Agricultural officer, Cuddapah Sri. K. Jagannatha Rao. The Co. 419 cane was introduced; deep ploughing was demonstrated with Cooper No. 26 plough, ridge plough was advocated for forming ridges and furrows; seed rate was reduced to the barest minimum of 10 thousand setts. The Karamat cane crusher replaced the old model wooden mill. The sum total of these new innovations and improvements was so effective that we had increased the acre yields by 60 to 70 md. of jaggery (worth Rs. 250) over the previous yields by older methods. Later on, Coimbatore varieties No. 421 and 2278 were introduced. Now in and round about my native village, Chennur, no other variety of sugarcane is grown, except the improved ones which occupy about 200 acres. The ryots are indebted to the Department for the increasing profits obtained through the cultivation of sugarcane.

R. 42 Ragi : The old system of cultivation of *ragi* was by broadcast. The fields were ploughed twice with the country plough, Guntaka. Ten cart loads of cattle manure were applied twice and spread and covered with a four tyned *gorru*, six Madras measures (18 lb.) of seeds was then broadcast. This was a tedious and expensive process. Twenty days after sowing 15 to 20 coolies were engaged in weeding. A fortnight later 10 to 12 coolies were engaged in thinning out thickly-sown places and in filling in the gaps. Due to irregular sowing resulting in thick sowing in one place and blanks in others, the crop used to be uneven. The best yield used to be 400 to 450 Madras measures per acre. In the year 1938 the local Agricultural demonstrator gave R. 42 *ragi* and demonstrated the nursery system of raising seedlings and then transfer planting them. A nursery of 10 cents in area (seed rate 2 Madras measures or 6 lb.) was raised to sow an acre. Demonstration plots of transplanted *ragi* and broadcast were raised side by side. The results were clearly in favour of the former, i.e. a yield of 30 Madras measures of the demonstration plot as against 520 of the local. Next year I repeated the experiment on a 4-acre plot. The Departmental variety under transplanted system gave 20 bags of 64 Madras measures each more than the local system. Thus R. 42 under transplantation came into vogue and we are now deriving benefit from the increased spread of this variety and the transplantation system of *ragi*.—Sri P. Yella Reddi, Chennur.

ERRATUM

Indian Farming, Vol. VI, No. 11, November 1945, page 545, line 16 :

for ' depends on the use of this important machinery. Financial considerations, however, compelled one to see the tractors at a very much reduced rate '.

read ' depends on this important factor. Financial considerations unfortunately at the time came in the way of my accepting the very kind offer of the B.O.C. to sell the complete outfit at a very much reduced rate '.

INDIAN FARMING

ISSUED BY
THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH

Vol. VII FEBRUARY 1946 No. 2

THE FUTURE OF INDIAN AGRICULTURE[1]

MR CHAIRMAN AND GENTLEMEN,

IT gives me great pleasure to welcome you here today on behalf of the Government of India and on my own behalf, for the sixth meeting of the Crops and Soils Wing of the Board of Agriculture. Your Board was formed in 1905, and completes 40 years of its useful existence. The Board has wisely formed itself into two Wings—the Crops and Soils Wing and the Animal Husbandry Wing—to meet in alternate years. This year it is the turn of the Crops and Soils Wing. By bringing together agricultural research workers, administrators, irrigation and agricultural engineers, University professors, heads of agricultural colleges, agricultural experts and farmers, the Board is providing a forum for interchange of ideas and experience, which will help in the formulation of a comprehensive agricultural policy, which the provinces and States will be prepared to implement and which the Central Government can vitalize and coordinate. Thus the Board provides a valuable link between the Centre and the provinces and States.

Your Wing has an unrivalled opportunity to serve the masses of India by making a substantial contribution by suggesting the lines on which surveys and other works should be carried out and modern methods introduced for increasing production and equipping the masses with practical knowledge to make the best use of land by drawing to the full on its productive capacity.

The war, which is just over, has brought home to us the precarious nature of our food production and the need of providing all varieties of food to meet the full nutritional needs of our population. According to standards laid down by Dr Aykroyd, we are largely deficit in production of

Pulses ..	.. by 2½ million tons
Vegetables (green) leafy and non-leafy	.. by 23 ,, ,,
Fruits ..	.. by 4 ,, ,,
Sugar ..	.. by 1 ,, ,,
Fats and oils	.. by 4 ,, ,,
Milk ..	.. by 18½ ,, ,,
Fish, meat and eggs	.. by 5½ ,, ,,

Now our objective can be no other but to fix production targets up to the estimated requirements. Freedom from want is an essential step towards the four freedoms which President Roosevelt declared as the need of the world.

I can assert without fear of contradiction that the prosperity of agriculture depends on a large scale development of industry, and by the creation of increased purchasing power. The agricultural worker must be provided an assured market and a remunerative price for his produce so that he is able to purchase industrial products. The interests of the consumers and producers are intimately linked together. Without prosperous agriculture, industry cannot flourish, and without industry, agriculture cannot improve. A sound agricultural economy cannot be developed by a mere tinkering with land tenures or by the employment of modern machinery, but by relieving the pressure of population on land and finding other occupations for surplus village population.

There is, however, a vast field for improvement. Scientific research has placed in our hands new means for food production, which, if we put them into full use according to a plan

[1] Inaugural speech made by the Hon'ble Sir Jogendra Singh, Member for Education, Health & Agriculture Departments, at the opening of the sixth meeting of the Crops and Soils Wing of the Board of Agriculture and Animal Husbandry held in New Delhi on 17 December 1945.

and pursue it with vigour, will enable us to move towards a new level of production hitherto considered beyond attainment. The remarkable achievements in producing high yielding sugarcanes, wheats, cottons, and rice are examples of what science has done in improving our crops. What we need is an adequate area under farms for production of mother seed and its multiplication by selected seed growers and cooperative village societies.

Then all the Provinces and States should survey and find means to bring all culturable lands under the plough, impound the monsoon rain which runs to waste; harness all the rivers to provide irrigation for thirsty lands and cheap power for our factories. Alladin had only one *jinn* to help him, while we have millions of *jinns* in our rivers waiting to be brought under control to serve and lighten the labour of man. Cheap power coupled with suitable machines can perform diverse functions on the farm. With the help of a low powered motor, the farmer can cut his fodder, shell his corn, sharpen his tools and draw water from his well for use in the home and at the farm. Electrification can modernize the rural areas, make them material-minded like the urban areas and perhaps deprive them of some of their ancient charm.

Indian diet is particularly deficient in protective foods. Our urgent need is to increase the production of milk. It depends on proper feeding and breeding of milch and other cattle. I am sure you will seriously consider as to how the present agricultural practice can best be adjusted to provide our livestock with optimum food in order to produce the milk which is so much needed by the people.

Fruits and vegetables are not available to an extent to feed the rich and the poor alike. In India, we have a variety of climates ranging from the arctic to the tropical. We can grow almost every variety of fruit and vegetable. So far we have been interested only in planting orchards for pleasure; we must now plant orchards for supplying the people with food. There is a great scope for producing fruit and vegetable juices, canning surplus fruit, manufacturing jams, marmalades and other fruit products. The Punjab and some other provinces have made a start in this direction. We have in our Fruit Adviser an enthusiast who has the power of communicating his enthusiasm to others.

India has joined the recently created Food and Agricultural Organization of the United Nations. One of the functions of this Organization is compiling of scientific knowledge and technique, assembling and analyzing all basic information and fostering cooperative action. The results of scientific research will be compiled and made available to member countries through a Bibliographic Service. Through this Organization, extension material including literature and films will be made available to us. The Food and Agricultural Organization will also maintain panels of experts, and will send technical missions to countries who desire their services. One of the objectives of the Food and Agricultural Organization is to ensure fair and equitable prices to the producers and with that object in view a complete survey is contemplated of world production, consumption and international trade in major agricultural products as compared with world needs for improved nutrition in view of the consumption goals set up by the member Governments. I record with pleasure and pride that India has played a worthy role through its delegation in contributing their share in shaping the constitution of this Organization.

Now you may ask what the Government has done to help agriculture. I am glad to say that it has been given to me to set up a separate Department of Agriculture. The Department is still in its infancy, but it is my purpose to staff it with those who have a bias for and a knowledge of the needs of agriculture. In Sir Pheroze Kharegat I have a Secretary who is devoted to the cause of agriculture and has spent many years of his service in promoting agriculture and cooperative development. In my old friend, Mr Stewart, your Vice-Chairman, you have an agriculturist of wide experience, great administrative capacity and untiring application.

We have a panel of special officers appointed as Advisers for Agricultural Production, Fertilizers, Seeds, Vegetables, Minor Works, Fruit, Livestock, Dairying, Fish, Plant Protection, Training and Forestry.

The appointment of an Adviser for soil conservation is under consideration. The Imperial Chemicals have lent us the services of Mr McIntyre in an honorary capacity and under him Dr C. N. Acharya is working as Chief Bio-Chemist. We have converted town refuse into compost in 312 towns to the extent of 270,000 tons. I am having a programme worked out for 5,000 centres to take up all our towns with a population of 5,000 and over, and when our plans are completed this should give

us two million tons of manure a year. I am also trying to get all the oilseeds crushed in the country itself, which would give us oilcake to feed our cattle and soil. A programme is being framed for the utilization of all available organic material for composting. It has been shown that water hyacinth, a troublesome weed which has choked the rice fields and rivers of Bengal, can easily be composted. I am hoping to start experiments to determine the cost of composting and determining its manurial value. If we in addition husband all our resources in bones, factory and slaughter-house refuse, we can have enough manure for our irrigated areas and its application should increase our yields at least by 50 per cent. A Bill to constitute an Oil Seed Committee is before the Legislature.

We will be setting up before long Research and Experimental Stations and Institutes in respect of Rice, Potatoes, Vegetables, Fruits, Grasslands, and Fish. The Dairy Institute, the Veterinary Institute, the Agricultural Institute and the Forest Institute will also be expanded. Financial sanction in principle for these new Institutes and for the expansion of the existing ones has been obtained.

We have Commodity Committees which are engaged in promoting research, production, marketing in regard to Sugarcane, Coconuts, Tobacco, Cotton, Jute and Lac.

Further, it is proposed to establish an Agriculture College and an Animal Husbandry College to meet the needs of smaller provinces and States and to provide for post-graduate education.

In the meanwhile the number of post-graduate students admitted to the Imperial Agricultural Research Institute has been increased from 15 to 50 per year and it is to be raised to 100 in due course. Admission to the Veterinary Institute has been doubled and admission to the Forest Rangers' College has been increased fourfold.

The Institutes which we are setting up, will carry out high grade research and afford facilities for training in the special subjects and may in due time supplement this by research work of an applied nature in other suitable areas and carry out pilot schemes of cooperative farming, joint management and test the use and extension of mechanized farming.

I am sure you will be interested in the special measures adopted in the Grow More Food Campaign and will make recommendations regarding those aspects of it which should be continued in the immediate post-war period and in normal times.

We have given in grants and loans for irrigation facilities, land clearance and improvement, manure for distribution, compost making, seed multiplication and distribution, bonus to cultivators for diverting areas from s. s. cotton to food crops, fish production and other purposes—Rs. 491 lakhs as loans and Rs. 417 lakhs as grants.

We have provided for the sinking of 11,200 wells and 2,215 tube-wells and it is expected that as a result of these measures there will be a substantial increase in production.

Gentlemen, your organization is on a small scale, but it has preceded the world Organization. Indeed I feel that we have forestalled, so far as development of agriculture is concerned, the national programme of development.

What we need is application of the knowledge and implementation of the programme to stimulate the practice of simple things, such as production of seed, husbanding all kinds of manure and extension of irrigation and work for the workless with cheap and abundant supply of money to raise our population from poverty to power. It has been said by Jefferson and Russell that 'let the farmer for ever more be honoured in his calling, for they who labour in the earth are the chosen people of God.' 'In a moral point of view, the life of the agriculturist is the most pure and holy of any class of men; pure, because it is the most healthful, and vice can hardly find time to contaminate it; and holy, because it brings the Deity perpetually before his view, giving him thereby the most exalted notions of supreme power, and the most endearing view of the divine benignity.'

I have great pleasure in inaugurating the session of the Crops and Soils Wing of Board of Agriculture and Animal Husbandry and wish you every success in your deliberations.

Original Articles

THE MONSOON OF 1945

India Meteorological Department, Poona

THE rainfall during the monsoon season of this year, though in amount 3 per cent in excess, was unevenly distributed over the country during the major part of the season. In June while the agriculturists on the west coast of India started sowing fields with bright hopes of a beneficient monsoon, the *kharif* crop operations in the northern areas of the Bombay Province were retarded due to insufficient rains.

The Bay branch of the monsoon was generally less active than the Arabian Sea branch and the depressions from the Bay during July and August were fewer in number than usual. Thus, south Bengal, Bihar, Orissa, Chota Nagpur and the east Central Provinces received less than the usual amount of rain. Insufficient rainfall and the setting in of 'break' conditions in the beginning of August, affected the transplanting of seedlings for the *aman* crop in some parts of Bengal.

Very heavy rainfall occurred in Gujarat in the third week of September, resulting in floods in the Tapti and other rivers and consequent loss of crops and property apart from serious dislocation of traffic and communications. Kathiawar suffered widespread damage to property and livestock due to incessant heavy downpours during the middle of July, and north Bengal and north Bihar were flooded by heavy rains in and near the Bhutan hills in August.

March of the monsoon

June: The Arabian Sea monsoon burst on the south Malabar coast on the 5th, causing heavy rain there. A second pulse of the advancing monsoon gave rise to a depression off the Kanara coast that formed on the 9th and weakened within two days. With the disappearance of the depression the monsoon began to sweep northward and extended in Kathiawar by the middle of the month. The feebly advancing Bay monsoon was drawn inland by a 'low' which formed over Chota Nagpur on the 16th, and for the next ten days both branches of the monsoon remained active. Widespread rain fell on the west coast, in the north of the Peninsula, the central parts of the country and north-east India. Heavy rains in south-east Bengal flooded certain tracts around Noakhali and caused considerable damage to the paddy crop there.

The rainfall for the rest of the month was mainly controlled by a depression which developed over Chota Nagpur on the 27th and travelling westwards, lay over Rajputana at the end of the month, causing heavy downpours in the central parts of the country, Rajputana and Gujarat.

Averaged over the plains of India, the rainfall during the month was deficient by 11 per cent.

July: Widespread and locally heavy rain fell in Sind, Gujarat, as well as on the west coast, on the first two days of the month as the last depression of June merged into the seasonal 'low' over Baluchistan. A cyclonic storm from the Bay that travelled westwards before breaking up on the Punjab-Kumaun hills on the 6th, closely followed by a depression that formed at the head of the Bay on the 7th and travelled inland as a low pressure area, gave heavy rain along their tracks. From the 10th to 20th, both branches of the monsoon were strong. Floods in the Goomti damaged paddy, jute and sugarcane crops in south-east Bengal. While heavy rains facilitated the sowing of maize and other *kharif* crops throughout the Dohad and Jhalod talukas in Gujarat, they wrought havoc on property and livestock in Kathiawar.

'Break' conditions set in on the 28th, and on the last two days of the month, rainfall was confined to the hills and the submontane regions from Bihar to the Punjab.

Averaged over the plains of India, the rainfall was practically normal, though there was an excess in the regions swept over by the Arabian Sea branch and defect in those swept over by the Bay branch.

August: No depression formed in the seas adjacent to India during the month. 'Break' conditions that had set in at the end of July continued till the 8th of August.

The monsoon revived after the 9th, but the activity of the Bay branch was restricted to

north-east India till the middle of the month. A 'low' over the west United Provinces on the 17th pulled both the branches well into the interior and in the next week widespread rain fell in the country except in Sind, Baluchistan, Kashmir and the south Peninsula. After extending into Kashmir at the beginning of the fourth week, both branches of the monsoon weakened after the 25th and rainfall was confined to the west coast and Assam.

Heavy floods in the Barhamaputra and the Kosi in the beginning and in the latter half of the month caused considerable damage to the crops and property in Bihar and east Bengal.

Averaged over the plains of India, the rainfall was 9 per cent below normal.

September : Rainfall during the month was mainly associated with four depressions from the Bay. The first depression started off the Circars coast on the 1st, moved rapidly inland and lay as a shallow 'low' over north Hyderabad the next day, causing heavy rain over Hyderabad, Berar and the Bombay Deccan.

The second depression started moving from the north Bay of Bengal on the 7th and reached Rajputana on the 13th. Associated with its movement heavy rain fell in Orissa, Chota Nagpur, the north Central Provinces, Central India, east Rajputana, the east Punjab and the west United Provinces.

The third depression starting off the Orissa-Circars coast on the 19th, travelled westwards up to Gujarat, recurved towards north-east and passing through east Rajputana, broke up on the Punjab-Kumaun hills on the 26th. Its passage was marked by a very heavy rainfall resulting in floods in the Tapti and the neighbouring rivers. Floods in Gujarat caused extensive damage to agriculture, destroying standing crops, affecting *bajri* and tobacco plantations, uprooting palm trees besides dislocating traffic and communications. Heavy rain in the Punjab-Kumaun hills was responsible for floods in Patiala.

The monsoon withdrew from north-west India on the 25th and was generally weak elsewhere for the rest of the month. Rainfall was widespread in Orissa, Chota Nagpur and the east United Provinces during the last three days of the month in association with a Bay depression that travelled through these regions.

Averaged over the plains of India, the month's rainfall was 26 per cent in excess.

The map shows the actual and normal rainfall for the period June to September in the various sub-divisions of India. The progress of the monsoon week by week is shown in Table I and day by day is shown in the accompanying diagram.

TABLE I

Progress of monsoon week by week, 1945

SUB-DIVISION	WEEK ENDING																	
	6-6-45	13-6-45	20-6-45	27-6-45	4-7-45	11-7-45	18-7-45	25-7-45	1-8-45	8-8-45	15-8-45	22-8-45	29-8-45	5-9-45	12-9-45	19-9-45	26-9-45	3-10-45
1. Bay Islands ..	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2. Assam ..	1·0	*0·4*	1·1	1·4	0·7	1·0	1·4	1·0	**1·9**	**1·7**	1·1	0·8	0·9	0·9	1·1	*0·4*	0·8	1·0
2(*a*). Upper Assam ..	1·4	0·5	1·0	**1·6**	0·8	0·7	**1·6**	*0·3*	**1·9**	**1·6**	0·9	0·8	1·1	0·9	0·9	*0·4*	0·7	0·9
2(*b*). Lower Assam ..	*0·4*	*0·3*	1·3	0·9	*0·4*	**1·8**	1·0	**2·4**	**1·9**	**2·0**	1·5	0·9	0·7	0·9	1·4	*0 3*	1·0	1·0
3. Bengal ..	0·6	0·8	0·7	1·2	0·8	*0·3*	1·0	0·7	1·5	1·0	1·1	1·5	1·0	0·8	0·9	*0·4*	0·6	1·5
3(*a*). Bengal, North ..	0·9	0·7	1·0	1·3	*0·3*	*0·2*	1·5	0·5	**2·3**	**2·2**	1·1	0·8	1·0	1·2	0·6	0·6	*0·3*	1·2
3(*b*). Bengal, South-east.	0·6	1·1	0·7	1·1	0·8	*0·3*	0·7	1·0	1·5	0·6	1·0	**1·7**	1·3	0·8	0·8	*0·2*	0·5	1·1
3(*c*) Bengal, South-west.	*0·2*	0·7	0·5	1·2	1·2	0·5	0·7	0·5	0·7	*0·2*	0·9	**1·8**	0·8	*0·3*	1·4	0·5	0·8	**2·1**
4. Orissa ..	*0*	0·5	0·5	1·1	**2·7**	0·5	*0·3*	0·6	*0·4*	*0·3*	0·6	0·9	1·1	*0·3*	1·5	1·5	0·9	**3·1**
5. Chota Nagpur ..	0·7	*0·2*	*0·1*	**2·2**	0·7	*0.4*	1·0	0·8	*0·2*	*0·1*	*0·4*	1·0	1·1	1·4	**1·8**	0·8	0·7	**2·5**
6. Bihar ..	*0*	*0·1*	0·7	0·8	*0·4*	*0·1*	1·3	*0·4*	1·3	0·8	0·5	1·0	1·3	0·8	0·9	**2·0**	0·5	**2·6**
7. U. P., East ..	*0*	*0*	*0·2*	1·3	*0·4*	*0*	**1·6**	*0·3*	1·3	*0·2*	0·7	1·1	1·1	0·5	1·5	**2·6**	0·5	**2·7**
8. U. P., West ..	*0*	*0*	*0·1*	0·5	0·8	1·0	**1·7**	0·9	1·4	*0·1*	0·5	1·0	**1·9**	1·5	**2·4**	**2·8**	**2·6**	**1·9**
9. Punjab, E. and N. ..	*0*	*0*	**1·6**	0·6	0·9	0·9	1·0	**1·6**	0·8	0·5	0·8	1·0	**1·6**	*0·4*	**2·1**	**3·4**	**8·8**	0·7
10. Punjab, South-west ..	*0*	*0*	*0·3*	*0*	*0·4*	0·5	0·6	0·8	**1·6**	*0·1*	*0*	1·5	**3·0**	*0*	1·0	*0*	1·0	**4·0**
11. Kashmir ..	0·7	1·3	0·7	*0*	1·0	**4·0**	0·6	1·2	0·7	0·5	0·5	*0·3*	0·5	*0·3*	*0·3*	*0·2*	**3·0**	0·5
12. N. W. F. P. ..	1·0	*0*	1·0	*0*	*0*	*0*	*0*	*0·3*	*0·2*	**2·5**	*0·2*	*0*	*0*	*0*	*0*	*0*	**3·0**	1·0
13. Baluchistan ..	*0*	*0*	1·0	*0*	**3·0**	1·0	*0*	**4·3**	**1·7**	*0*	0·5	**3·0**	*0*	*0*	*0*	—	—	*0*
14. Sind ..	*0*	*0*	**3·0**	*0*	**5·4**	*0·3*	*0*	**1·9**	*0·4*	*0*	*0*	*0·3*	*0*	*0*	*0*	*0*	*0*	—
15. Rajputana, West ..	*0*	*0*	*0·3*	0·7	**2·6**	**2·6**	**2·3**	1·1	**2·3**	*0*	0·8	**2·2**	*0*	*0*	0·7	**1·7**	**8·5**	*0*
16. Rajputana, East ..	0·5	*0*	1·4	*0·2*	**3·1**	**1·8**	**2·3**	**2·5**	0·9	*0*	0·9	**1·8**	1·4	0·6	1·2	*0·3*	**5·0**	*0*
17. Gujarat ..	**5·0**	*0*	1·4	0·6	**2·6**	**2·2**	**1·6**	0·6	1·0	*0·2*	1·3	**3·4**	*0·4*	*0*	*0·2*	*0·3*	**14·0**	*0*
18. C. I., West ..	*0*	*0*	*0·4*	0·7	**4·1**	**2·0**	0·8	0·8	0·7	*0*	1·1	**2·0**	0·6	1·0	1·3	*0·2*	**1·8**	*0*
19. C. I., East ..	*0*	1·3	*0·1*	1·1	1·0	1·0	0·9	0·9	0·8	*0*	0·9	**1·7**	0·5	*0·4*	**4·2**	1·4	0·6	*0*
20. Berar ..	*0·1*	*0·1*	*0·4*	**1·9**	1·1	1·2	1·0	1·0	0·8	*0·3*	1·5	**2·1**	*0·1*	**3·6**	0·5	*0*	**6·5**	*0*
21. C. P., West ..	*0·3*	*0·1*	*0·3*	**2·1**	**2·5**	**2·3**	0·8	**1·6**	0·9	*0·2*	**1·6**	1·1	0·6	0·8	1·2	*0·3*	**1·6**	*0·1*
22. C. P., East ..	*0·1*	*0·1*	0·8	0 8	1·3	1·4	0·6	1·1	0·7	0·5	0·8	**1·6**	0·5	1·1	**2·2**	**1·9**	**2·8**	*0·3*
23. Konkan ..	*0·3*	1·0	1·2	1·3	0·7	1·4	1·1	**1·9**	0·6	1·1	**2·0**	0·9	0·5	0·8	1·0	0·7	1·3	*0·1*
24. Bombay Deccan ..	1·4	*0·4*	0·5	0·7	0·7	**2·2**	0·7	0·7	0·7	1·5	**3·2**	0·9	*0·3*	1·0	*0·3*	*0·2*	1·1	0·5
25. Hyderabad, North ..	0·5	*0·2*	1·5	**2·2**	0·7	1·2	0·5	0·9	0·8	0·7	1·3	1·5	*0·3*	1·3	*0·4*	*0*	**2·5**	*0·3*
26. Hyderabad, South ..	*0·3*	*0·3*	**1·6**	1·2	0·9	1·0	0·8	**2·3**	**1·7**	0·9	1·1	*0·4*	0·9	**2·9**	*0·2*	*0·1*	*0·3*	*0·4*
27. Mysore ..	*0·3*	*0·1*	*0·3*	*0*	*0·2*	**1·6**	*0*	1·3	**1·7**	**2·8**	1·0	*0·3*	0·7	*0·4*	0·8	*0·1*	*0·1*	0·6
28. Malabar ..	0·7	**1·7**	0·6	0·7	1·0	**1·7**	*0·4*	1·5	0·7	1·2	0·9	**1·8**	0 5	0·5	0·7	*0·4*	0·8	*0·4*
29. Madras, South-east ..	0·7	*0·3*	*0·3*	*0*	0·5	*0·4*	*0·4*	0 6	1·4	**1·6**	0·5	*0·3*	**2·0**	*0·2*	0·7	0·7	*0·1*	1·0
30. Madras Deccan ..	0·9	*0*	*0·2*	*0·2*	**1·8**	*0·3*	*0·3*	**2·3**	**3·6**	1·0	*0·3*	*0·1*	0·9	1·5	0·8	*0·1*	*0·1*	1·1
31. Madras Coast, N. ..	*0·2*	*0·1*	*0·2*	0·6	*0·3*	1·5	1·5	0·7	0·9	1·2	0·7	7·7	*0·4*	**1·7**	0·7	1·3	0·8	1·2

The figures in the Table represent the ratios of the actual rainfall to the normal rainfall. For example, in the week ending 1-8-45, the figure 1·3 printed against Bihar, means that in that division, the actual rainfall during the week was 1·3 times the normal.

Figures in thick type indicate large excess, i.e. over 50 per cent above the normal, and figures in italics, large defect, i.e. over 50 per cent below the normal.

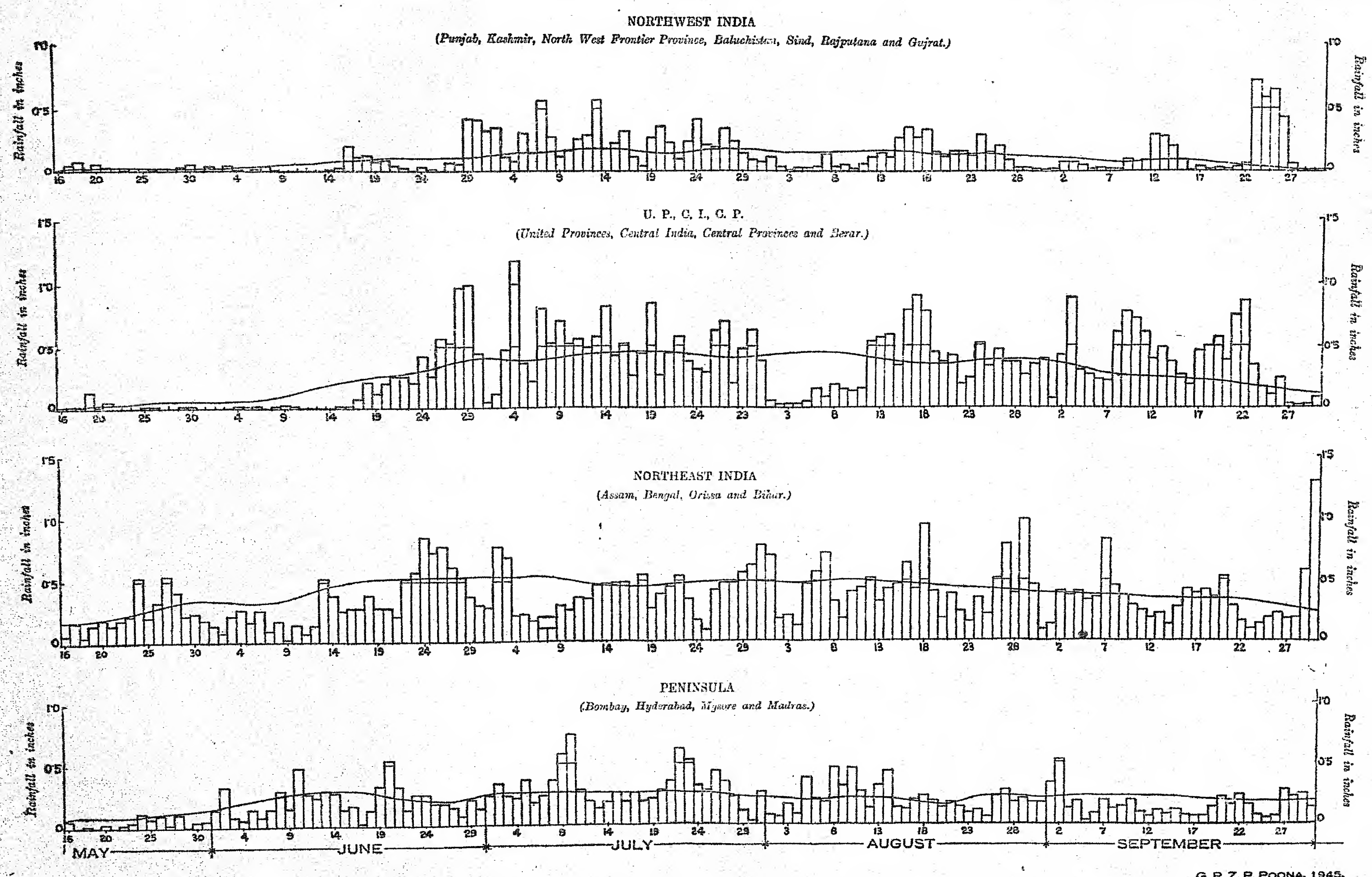

FIG. 1. Progress of the monsoon day by day (16th May to 30th September 1945). The stepped curves represent the actual rainfall and the continuous curves the normal rainfall

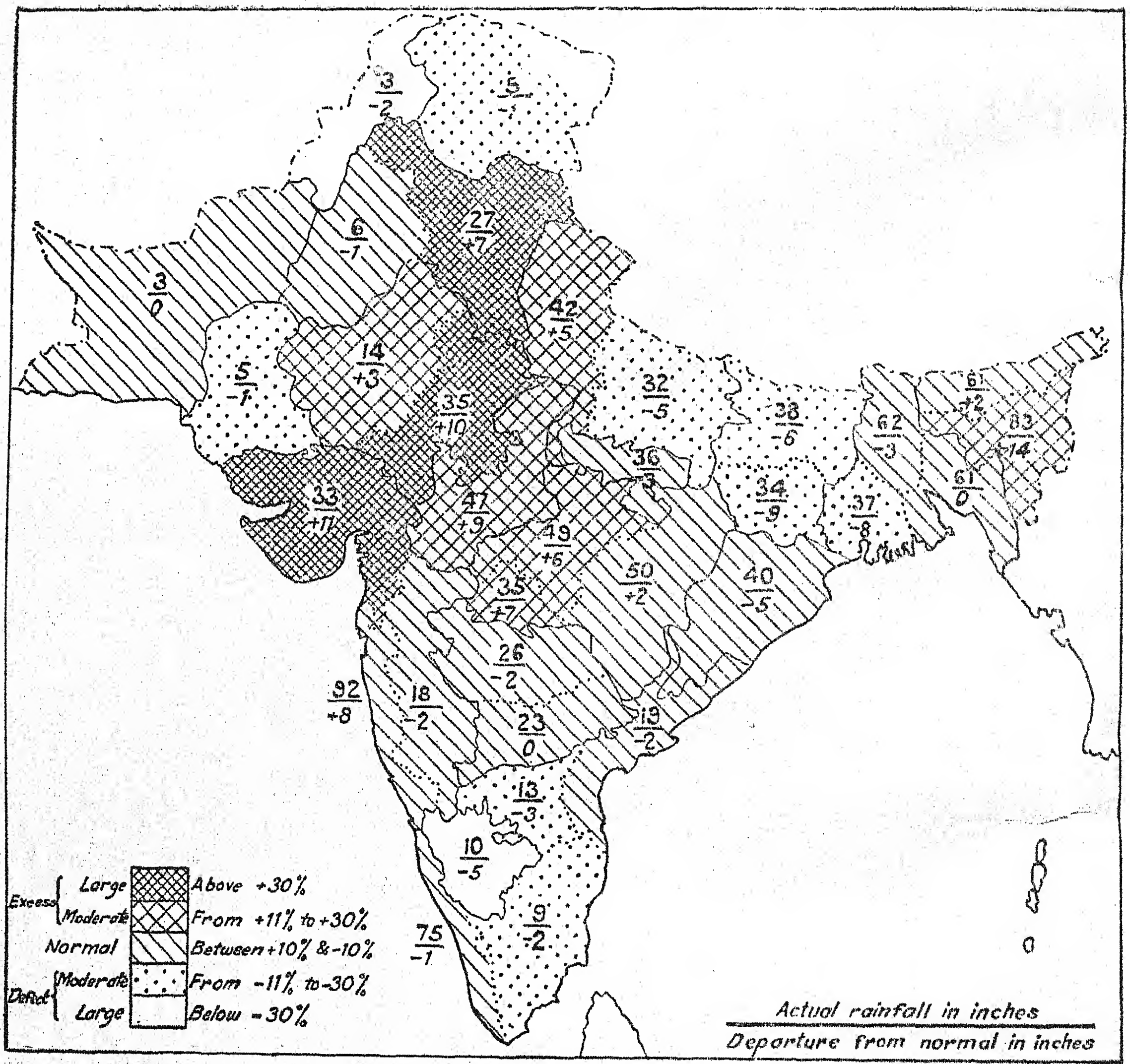

FIG. 2. Actual and normal rainfall—June to September, 1945

PYRETHRUM CULTIVATION IN KUMAUN (UNITED PROVINCES)

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IN 1943 the Government of the United Provinces were requested by the Department of Supply, Government of India, to undertake the cultivation of pyrethrum (*Chrysanthemum cinereriaefolium*) for use as an insecticide for the army. The account which follows is a record of the attempt to cultivate this crop on a commercial scale.

Among other medicinal plants, this plant had already been tried on an experimental basis at various agricultural stations in the United Provinces, and it had been found to grow fairly satisfactorily at altitudes of not less than 5,000 ft. The trials showed that, as far as the U.P. was concerned, its cultivation would have to be confined to Kumaun, and that it was useless to attempt to grow it in the plains. Endeavours were first made to induce the hill cultivators to undertake its cultivation, but owing to the scarcity of arable land, high prices for food crops and amount of labour involved, added to their reluctance to take up a completely unfamiliar crop, this had to be abandoned and arrangements were made to grow it on Government land under Government supervision.

In this we were fortunate as the Government Fruit Orchard, Chaubattia, situated near Ranikhet at an elevation of 6,500 ft. already had 5½ acres under experimental pyrethrum and was able to spare an additional 6½ acres of land which was cleared and planted up in September, 1943. To increase this area, 50 acres of standing forest, the property of the Ranikhet Cantonment was handed over in November, 1943. This was felled and cleared, the timber being utilized for building purposes and fuel, and 40 acres being found suitable, was planted up.

Thus at the time of writing we have a total of 52 acres under this crop.

Conditions of growth

As far as Kumaun is concerned the plant must be grown at an elevation of not less than 5,000 ft. in well-drained soil, in an open situation and preferably in areas with a light monsoon rainfall. It will not tolerate heavy continuous rains, and is immediately affected by water-logging and a hot damp atmosphere, such as obtains in the lower valleys during the monsoon. Trial plots were laid out at different elevations and in different situations in 1943 and in all cases where the conditions were hot and humid in the monsoon, and the drainage bad, the plants failed completely. Cold in the winter season appears to have no adverse effect. During the exceptionally severe winter of 1944-1945, the plants at Chaubattia were covered for nearly a month by 2 to 3 ft. of snow but suffered no ill-effects.

Propagation

The plant can be propagated either from seed by transplanting from a nursery bed, or by splitting mature plants and planting out rooted splits direct in the field. The latter method is preferable as splits are easier to transplant and produce a flowering crop more rapidly than transplanted seedlings.

In the case of seeds, nursery beds can be sown in September and transplanted in the following March, or sown in March and transplanted in the following August-September. Seedlings are transplanted when about 6 in. high. In the same manner splits can be put down in either March or September.

In Chaubattia the best results have been obtained from transplantations carried out in March.

A well-drained seedbed is required, sowing should be thin, and the seedlings must invariably be protected from heavy rain as they are very liable to damp off. Seed is required at the rate of 1 lb. for every acre to be planted out. Germination is usually somewhat defective and the mortality among seedlings is fairly high. By far the best results have been obtained at Chaubattia with acclimatized seed descended from the original seed imported from Messrs Vilmorin of Paris in 1931. In 1943, 40 lb. of

seeds was obtained from the Nilgiris. These both in germination and in the subsequent vigour and yield of the mature plants were considerably inferior to the acclimatized seed.

The seedlings are set out in rows 18 in. apart with a distance of 18 in. between plants. Pyrethrum in Kumaun does not require a very rich soil but thrives best under medium to light soil conditions with good drainage. The latter is absolutely essential. No manure was given as the land was cleared forest and was in good heart, though this might be necessary in a poor soil. Afterwards cultivation consists of weeding and breaking up the soil between the plants. Intercultivation should not, however, be carried to excess otherwise owing to the steep slopes, the top soil will be washed away in the monsoon. Watering is necessary in Kumaun during hot dry weather and immediately after planting out, unless rain storms are unusually frequent.

It may be mentioned that during the time pyrethrum has been grown at Chaubattia, it has not been affected by any pest or disease. As it is a perennial plant the work has not gone far enough to make any recommendations regarding its place in a rotation.

Harvesting

The plants begin to flower in the latter half of May. The flush of flowers comes on very quickly and is all over in a fortnight. Harvesting has therefore to be carried out expeditiously, if the flower-heads are not to run to seed. In October, after the close of the monsoon, a second flowering takes place, but the yield from this flush is insignificant compared to the summer flowering. To obtain the highest content of pyrethrin, the best time to pick is when half the yellow inner disc florets are open. The flower-head only is picked and none of the stalk or leaf. After picking the heads should at once be spread in a thin layer in the sun and completely dried. This is of importance as, if they are left lying about in bags or baskets, they very quickly ferment. When thoroughly dry they can, if a press is available, be baled, otherwise they should be securely packed in double gunny bags before despatch. If seed is required the best plants are allowed to ripen off until the seed is about to shed; the heads are then picked, dried, and at once packed in sealed containers.

Yield

Under Kumaun conditions the plant appears to be a perennial. Full flowering takes place in the second year after sowing and continues thereafter annually. The plant assumes a clump-like habit of growth and after four years the clumps should be lifted, split up and replanted. The yield from two year old plants has averaged 54 lb. dry flower-heads per acre. This is very low when compared to Kenya where the yield averages 600 to 800 lb. per acre.

Actually during 1945, 34½ md. of dry flower-heads and 98 lb. of seeds have been produced and despatched from Chaubattia.

Pyrethrin content

The effectiveness of pyrethrum as an insecticide depends on its pyrethrin content. The standard for commercial pyrethrum fixed by the Kenya Pyrethrum Board is a guaranteed minimum of 1·30 per cent. Japanese pyrethrum usually contains 0·6 per cent to 1 per cent pyrethrin.

Pyrethrin estimations have been carried out at Chaubattia with the following results:

	1943	1944
Pyrethrin I	0·877	0·700
Pyrethrin II	0·346	0·374
Total	1·223	1·074

Estimations in 1945 could not be made owing to non-availability of certain necessary chemical reagents at harvest time.

Costs

Owing to the fact that there is at present no open market for pyrethrum, all supplies being strictly controlled, and to the arrangement whereby all produce has been taken over by the Department of Supply, Government of India, on a 'no profit no loss' basis, it is difficult to give figures of receipts and expenditure.

In 1945 the cost of production of dry pyrethrum worked out at just under Re. 1 per lb. This is from crop two years old yielding at the rate of 54 lb. dry flower heads per acre.

The cost includes labour and all running expenses but excludes the cost of clearing the land, land rent and superior supervision. If these are included the cost would be very much higher.

PYRETHRUM AT CHAUBATTIA (Kumaon)

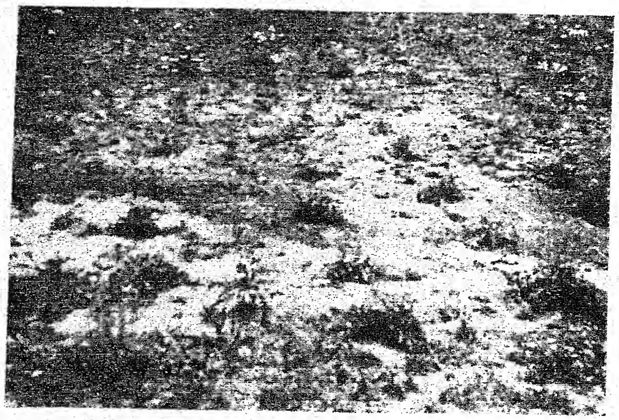

FIG. 1. Young plants in the field

FIG. 2. Before harvest

FIG. 3. Harvesting

FIG. 4. Drying heads

PLATE 12

As a comparison growers in Kenya obtained the following per lb. (reduced to Indian currency) for their produce.

1938	As.	7–6
1939	Rs.	1–3–9
1940	Re.	1
1941	As.	10–3
1942	As.	6
1943	As.	12

The high cost of production is due to

(a) *Low yield:* An average of about 60 lb. per acre from crop in full bearing ill compares with 600 to 800 lb. per acre in Kenya. In Kenya the crop flowers for nine months in the year and pickings are made whenever the weather is favourable, whereas in Kumaun there is only one short flush of flowers in May, and thereafter flowering ceases till the second insignificant flush which takes place after the close of the monsoon.

(b) *High cost of cultivation:* In Kumaun the entire cultivation of the crop from beginning to end has to be carried out by hand labour. Owing to the small terraced fields and the very steep slopes it is not feasible to use bullocks for the preparation of the land or for after-cultivation. In the particular place where our pyrethrum was grown, as in many other parts of Kumaun, there is inadequate irrigation and hand watering of the plants had to be resorted to in the hot dry weather thereby greatly adding to the cost. A further adverse factor is the very high cost of labour in the hills at the present time.

Conclusions

Though it has been proved that this crop can be grown under certain conditions in Kumaun the work described has been carried out purely as a war time measure. The question arises whether pyrethrum could ever become a source of profit as a field crop to the hill cultivators in normal times. In the opinion of the writers this is not likely to be the case.

Apart from the fact that pyrethrum may be superseded in the near future by synthetic insecticides such as D.D.T. the very low yields obtained, combined with the amount of labour involved in its cultivation, makes the cost of production so high that it seems unlikely that it could compete under normal circumstances with pyrethrum produced in other parts of the world or indeed in more favoured parts of India. Added to this, it is a field crop which requires to be grown on existing or potential arable land and is thus in direct competition with food crops. Arable land in Kumaun is already insufficient and even if it was a reasonably profitable crop, it is questionable whether under present food conditions in India, it would be desirable to divert arable and to its cultivation on a large scale.

JUTE SUBSTITUTES

JUTE cloth being normally the cheapest packing material, and the production of the fibre being virtually confined in India, countries outside India have, therefore, often attempted to develop substitutes, states a booklet on *Jute Substitutes,* recently released by the Indian Central Jute Committee. These attempts have generally taken three lines. These are : (1) Development of an acclimatized variety of jute itself, (2) development of other fibres likely to do the work of jute, (3) dispensing with any packing material altogether by resort to practices like bulk-handling.

The most important among the factors directly responsible, explains the booklet, for the growth of substitutes are : (1) Price, (ii) choice of consumer, (iii) the search by a country for new uses for its surplus material, (iv) policy of national self-sufficiency in respect of packing material, (v) scarcity of jute and jute products during war time and (vi) development of mechanical contrivances for bulk-handling, e.g., grain elevators.

The booklet also gives an extensive list of the substitutes and all available useful information regarding them.—*I. C. J. C.*, January 9, 1946.

RELATION BETWEEN NITROGEN CONSERVATION AND QUANTITY OF HUMUS OBTAINED IN MANURE PREPARATION

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THE view is sometimes advanced that in the preparation of bulky organic manures such as farmyard manure or composts, it is the humus content that is of primary importance and the fate of nitrogen, phosphoric acid, etc. is secondary, since these latter constituents are present in forms which are only partially and slowly available and could be effectively replaced by the addition of readily available mineral fertilizers. The object of this note is to point out the inter-relationship that exists between the quantity of nitrogen conserved in the process of manure preparation and the quantity of humus obtained. The position in regard to phosphoric acid is not yet clear, since investigations have been meagre on this subject.

'Starter' or 'activator'

In regard to nitrogen, however, investigations have shown definitely that refuse materials of wide C/N ratios such as litter, straw, crop wastes, dung, town refuse, etc. decompose at a faster rate if a certain quantity of easily available nitrogenous material, e.g. cattle urine, slaughter-house wastes, night-soil, sewage or mineral nitrogenous supplements be added so as to bring the initial C/N ratio of the compost mixture to within the range 25 to 30. All good systems of farm manure or compost preparation now proceed on this basis of decomposing mixed organic refuse low in nitrogen (the so-called carbonaceous material) by the addition of a nitrogenous supplement ('starter' or 'activator').

'Mature' manure

Numerous investigations have also definitely shown that when the above compost mixture possessing an initial C/N ratio between 25 to 30, is allowed to undergo natural decomposition by the mixed micro-flora already present in the waste materials or inoculated thereinto by added garden earth or dung emulsion, a considerable amount of heat and evolution of carbon dioxide takes place; and if conditions of moisture and aeration be optimum, the material shows a progressive lowering of the C/N ratio, which ultimately tends to stabilize itself near a level of 10. The manure is said to be 'mature' and fit for application to land when it has reached the above C/N level of 10. In certain cases, where a period of two to three months may elapse between the application of the manure to land and the sowing of crop, it would be permissible to apply manure of C/N ratio somewhat wider than 10, say between 15 and 10; but the arguments presented in the following paragraphs are applicable at any level of C/N ratio fixed for the final manure.

Balance sheet

For purposes of illustration, presuming that the farmer desires to compost his waste material down to a C/N level of 15 and that he initially started with 100 lb. (dry matter) of mixed wastes containing 30 lb. of carbon and 1 lb. of nitrogen (initial C/N ratio 30), the initial balance sheet of his compost material would be roughly as shown in column (b) of Table I.

TABLE I

Balance sheets of different systems of compost making

Constituents	Initial	Final manure (C/N=15)		
		No nitrogen lost	50 per cent nitrogen lost	50 per cent nitrogen lost but atmospheric nitrogen fixed
(a)	(b)	(c)	(d)	(e)
	lb.	lb.	lb.	lb.
Nitrogen	1	1	0·5	0·5 lb. +0·1 lb. nitrogen fixed from air by 20 lb. carbon
Carbon	30	15	7·5	9·0
Organic matter or humus	75	30	15·0	18·0
Ash (residue on ignition)	25	25	25·0	25·0
Total dry matter	100	55	40·0	43·0

If the farmer is careful enough to adopt a system of manure preparation in which no appreciable quantity of nitrogen is lost, the final balance sheet of the compost would roughly correspond to the details given in column (c) of Table I. If, however, the farmer adopts careless systems of manure preparation, which may easily involve losses of nitrogen upto 50 per cent of the quantity initially present, the final picture would be as shown in column (d).

Humus and nitrogen

A comparison of the figures given in columns (c) and (d) shows that the quantity of humus obtained in the final manure (whether it be defined as corresponding to a C/N ratio of 15 : 1 or 10 : 1) is definitely proportional to the quantity of nitrogen conserved in the compost system. In other words, in order to obtain the greatest quantity of well-humified manure, it is necessary to avoid all sources of nitrogen loss (either by seepage into the ground in the rainy season or by volatilization into the air as ammonia or gaseous nitrogen in the dry season).

Two plausible arguments that are sometimes advanced to evade the above conclusion are : (a) loss of nitrogen would only widen the C/N ratio of the final manure, but the quantity of carbon and thus of humus obtained would be the same after any particular interval of time, say four months from the start of decomposition and (b) any nitrogen lost during compost preparation would be automatically made up by nitrogen fixation from the air, leading to a product of C/N ratio near 10 : 1 or a nitrogen content of about 2 per cent in all cases. It would be useful to remove the misapprehension created in the minds of the farmer by the above two arguments.

As regards hypothesis (a) above, it is clear that if the C/N ratio of the manure is wider than 15 : 1 it has not humified completely and the quality of the manure is bound to be poor. In fact, it cannot be applied to standing crops as a top dressing, as humus of good quality can be done, nor can it be applied to land shortly before sowing crops. In both cases, it is likely to have an immediate adverse effect on the growth of the crop. It can only be applied to land some months before sowing, in order to complete the remaining stage of humification in the soil itself. In several cases, the land or climatic conditions may not be ready to receive the manure at such an early stage.

Quality of manure

In addition to the above, it may be mentioned that the work carried out by the writer indicates that the quality or 'effectiveness' of an organic manure depends, on the amount of 'mobile' nitrogen (e.g. nitrogen contained in urine, night-soil, sewage or minerals) which has been 'immobilized' or converted into microbial tissues within the compost. In good quality farmyard manure or compost this fraction may represent about 30 to 50 per cent of the total humus ; and it is easily nitrified in the soil and becomes available to crops. To the extent that such 'mobile' nitrogen is allowed to be lost during the process of manure preparation, to that extent the quality of the manure prepared (availability of its nitrogen) is bound to suffer.

Recoupment of nitrogen

In regard to hypothesis (b) above, viz. recoupment of nitrogen lost during composting by nitrogen fixation from the air, various investigations carried out in India have shown that the rate of nitrogen fixation averages about 3 to 5 mg. nitrogen per gram of carbon oxidized from refuse materials of the type used in compost-making. Taking the higher value of 5 mg. nitrogen fixed per gram of carbon oxidized, the balance sheet of the compost shown in column (d), Table I would be altered to the position shown in column (e).

A comparison of the data shown in columns (d) and (e) would clearly show that the quantity of nitrogen fixed from the air is so low, that it does not make up even a fraction of the large quantities that are easily lost due to careless handling. The losses are specially high in cases where the farmer takes extra trouble to collect cattle urine, dung and softer plant tissues, with a view to improving the quality of his farm manure or compost. Unless he adopts special precautions to avoid loss of nitrogen in such cases, he may easily find that all his labours have been wasted and he is in no better position finally than his easy-going brother who was content to prepare manure of poor quality and low quantity.

As regards methods for the conservation of nitrogen during manure preparation, these have been dealt with in detail by the writer elsewhere[1].

[1] *Indian Farming*, Vol. VI, Nos. 5 and 12

IMPROVEMENT OF COTTON IN CENTRAL INDIA

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COTTON is the principal money crop of Central India and occupied an area of about twelve lakh acres in 1941-1942. This area is now considerably reduced on account of the 'grow more food' campaign launched by the Central Government and Indian States. The cotton produced in this tract goes under the trade name of *Oomras* and is considered suitable for spinning up to 10 to 12 counts (Highest Standard Warp Counts). Practically the whole crop of cotton in Central India is grown under *barani* conditions, that is without irrigation, and the average yield per acre is low, namely two maunds of seed cotton per acre. It will thus be seen that the cotton is both poor in quality and yield. A scheme was, therefore, started in 1924 to improve the yield and quality of the indigenous cottons of Central India at the Institute of Plant Industry, Indore.

The problem of cotton improvement

The problem of cotton improvement in Central India is complicated by the fact that the cotton commonly grown by the cultivators is a mixture in varying proportions of two distinct species—the *desi* (*G. arboreum var. neglectum* H. & G.) and the introduced American (*G. hirsutum*). In Malwa—a high tableland about 1,200 to 1,800 ft. above sea level with deep black soil and an annual rainfall of about 30 to 40 in.—the proportion of these is 40 : 60, whereas in Nimar— a low-lying plain about 500 to 700 ft. above sea level with lighter and more open soil and about 30 in. of rain per year—the proportion is 80 : 20. In portions of Malwa, particularly on *adhan* lands, the American cotton is grown almost pure. This cotton responds very well to manuring and irrigation, but fails as a *barani* crop in years of scanty rainfall.

Studies on crop population in Central India have shown that American cotton has become established as a permanent component of the mixture. Experiments conducted at the Institute have shown that while in pure plots the *desi* cotton gives a considerably higher yield than the American, in plots containing the mixture the American suffers less from diseases and its growth and vigour are better. The mixed product is of better quality than the pure *desi* and spins 3 to 4 counts higher than the average spinning value of the individual components. It has also been shown by experiments that though this mixture is not as profitable to the cultivators as a pure variety of *desi* cotton under *barani* conditions, still the mill owners prefer its cultivation since the presence of the American cotton in the mixture imparts a softness to the lint and makes it suitable for spinning higher counts. The cultivators also show a preference to the growing of the mixture as in years of heavy rainfall, the American component thrives better while in years of scanty rainfall the *desi* does well.

Types of desi *cotton*

On the basis of leaf shape and flower colour, the *desi* component can be distinguished into the following four botanical types, each having general distinct characteristics with regard to ginning percentage and fibre quality :

(1) *Malvense* with broad leaf and yellow flower
(2) *Verum* with narrow leaf and yellow flower
(3) *Roseum* with narrow leaf and white flower
(4) *Cutchicum* with broad leaf and white flower

The *malvense* is the predominant type in the Malwa tract and *roseum* the predominant type in Nimar. It was once believed that Malwa produced a very good type of cotton, soft in texture and of a medium staple length, which had deteriorated later on owing to the influx of the high ginning and poor quality *roseum*. Investigations undertaken at the Institute have, however, shown that it was Nimar which has suffered by the invasion of *roseum*, that *roseum* has a low survival value in Malwa, and that the deterioration in quality of *malvi* cotton was largely due to the great extension of the area under cotton which has resulted in the crop being grown on lands not suitable for it. Statistics for the whole of Central India do not exist, but the area under cotton in the Holkar State, which may be taken as typical of Malwa plateau, has increased fifteen times during the last 50 years or so, that is from 51,000 acres in 1886 to over seven lakhs in 1940.

The unselected mixture varies in lint length from 14 to 22 mm., gins about 29 per cent and

has a spinning value of 10 to 12 H.S.W. counts. It is also somewhat late and the third picking is often lost if frost occurs in mid-January as it usually does once in five or six years.

The problems tackled

The problems which the Institute sought to tackle were (i) to evolve a strain of *desi* cotton of *malvense* type for growing as a *barani* crop for the Malwa plateau which gives not only higher yield of *kapas* (seed cotton) per acre than the mixture, but also possesses lint of a better quality suitable for spinning up to 20's and matures before mid-January, (ii) to isolate a strain of American cotton which can be grown as a pure crop on *adhan* lands and (iii) to evolve a strain of *desi* cotton better than *roseum* suitable for growing under Nimar conditions.

Selections of desi *cotton*

The first step towards improvement of cotton in Central India by scientific methods was taken in 1924. Samples of Malwa cotton were obtained from several places and grown on the Institute farm. A large number of single plants of both Upland and *malvense* types was selected from cultivators' fields as well as those of the Institute.

These plants were grown in subsequent years and further selection from selfed plants on the basis of higher lint length and ginning outturn was continued until, by 1930, the number of selections of *desi* cotton was reduced to ten only. Since yield was of primary consideration, these ten selections, which were superior in lint length and ginning outturn to the local mixture, were for the first time, in 1931, compared against the latter for the yield of *kapas*. Although the trial was not carried out according to the latest methods of field experimentation, the yield differences among them were so wide that five more selections were rejected. In the next two years, the remaining five selections were again tested against the local mixture in randomized and replicated trials not only at the Institute but also at several other places in the Malwa tract. Out of these only two, namely *malvi* No. 1 and *malvi* No. 9 were the most outstanding in their performances. In 1934-1935 these two strains were again tested throughout the Malwa tract against the local mixture and also against improved strains from neighbouring provinces. These trials again proved the superiority of these strains over both the local and imported strains. Table I below gives the economic characters of *malvi* No. 1 and 9 and the local mixture.

TABLE I

Economic characters of malvi *No. 1 and 9 and the local mixture*

Year	Strains	No. of trials	Yield per acre in lb.	Percentage picked before frost	Maximum Halo-length in mm.	Ginning percentage	Spinning value
1932–1933	*Malvi* 1	4	580	93·7	21·7	29·3	13·3
	Malvi 9	4	554	91·7	22·5	32·3	15·5
	Local	4	484	91·1	19·8	28·7	12·2
1933–1934	*Malvi* 1	6	409	91·6	22·9	31·0	12·2
	Malvi 9	6	413	89·6	23·2	33·3	16·8
	Local	6	330	85·6	21·3	29·6	11·5
1934–1935	*Malvi* 1	7	332	74·3	23·9	29·3	14·0
	Malvi 9	7	357	65·1	24·3	31·9	20·0
	Local	7	325	63·3	23·6	28·5	..
Percentage increase over the local mixture							
	Malvi 1		15·9	8·2	5·8	3·2	10·6
	Malvi 9		16·2	7·2	8·2	12·3	47·0

It will thus be seen from Table I that both strains are better than the local mixture in all characters. *Malvi 9* is better than *malvi 1* in all characters except earliness. Owing to the keen demand for improved seeds, it was decided to issue seeds of *malvi 1* cotton to the cultivators in 1934 and replace these with the seeds of *malvi 9* as soon as sufficient supply of pure seeds was built up. *Malvi 1* was completely replaced by *malvi 9* in 1938-1939.

With the help of replicated progeny row technique evolved at the Institute it was possible to further exploit the variability still present in *malvi 9* and five sub-strains, namely *malvi 9-13, 9-15, 9-17, 9-19* and *9-20* were isolated. Later on these five strains were

tested against *malvi 9* in varietal trials for yield and economic characters. From among these *malvi 9-20* was found to be the most suitable strain for replacing *malvi 9*, as it gave the same yield but was definitely superior to the latter in quality.

Breeding for wilt resistance

During these years when breeding work for improving the economic characters of *desi* cotton was going on at the Institute, a fungus disease known as wilt (*Fusarium vasinfectum*), to which the *desi* cottons are highly susceptible, appeared in some of the Institute fields and gradually the incidence spread to most other fields. The problem of improvement of cotton, therefore, became more complicated and breeding for wilt resistance became a pressing necessity. This was soon started by making a large number of new selections from wilt-affected fields and also by making several crosses between *malvi 9* and *malvi 9-20* on one side and resistant or immune types like the *jarila*, *verum 434*, and *Million Dollar* on the other. In 1940-1941 a few of the best progenies from *Dhar mass malvi* cotton were tested against *malvi 9-6* (a somewhat resistant strain from *malvi 9*) on wilt affected fields. One of these progenies, namely No. 2, showed significantly higher resistance to wilt than *malvi 9-6*. It was also significantly better in the yield of *kapas* and in ginning outturn, as shown below :

Strain	Yield of *kapas*	Maximum Halo-length	Ginning percentage	Final stand as percentage of germination
Progeny No. 2	1024·5 gm.	28·4 mm.	33·6	85·7
Malvi 9-6	604·8 „	27·9 „	29·7	63·9
Statistical error	85·2	·21	·25	6·3
Significant difference	262·5	·60	·80	18·3

In the following season progeny No. 2 later on known as *family 2* was again tried against *malvi 9*, *malvi 9-20* and *jarila* on wilt-affected fields in a randomized block trial. *Family 2* and *jarila* gave all round better performances than *malvi 9* and *malvi 9-20*. Table II gives the comparison of *family 2* with other strains.

TABLE II

Comparison of family 2 *with other strains*

Strains	Yield of *kapas* per acre	Maximum Halo-length	Ginning percentage	Final stand as percentage of germination	Fibre properties as determined by the Cotton Technological Laboratory, Bombay, in 1941-1942		
					Mean fibre length	Mean fibre weight per inch 10^{-6} oz.	H. S. W. C.
Family 2	270 lb.	25·2 mm.	32·5	96·1	0·765 in.	0·169	22
Jarila	272 „	27·6 „	31·2	95·6	0·800 in.	0·155	27
Malvi 9	201 „	25·6 „	31·1	..	0·765 in.	0·183	17
Malvi 9-20	133 „	25·4 „	31·4	60·6	0·770 in.	0·171	18
Statistical error	15·17	·22	·34	3·4	..	..	..
Significant difference	42·9	·60	1·00	9·6	..	..	..

Family 2 renamed as *bhoj cotton* 43, which is as good as *jarila* in wilt resistance under field conditions and equal to *malvi 9* in the yield of *kapas*, has therefore been multiplied and is being sent for trials along with *malvi 9* and *jarila* to several member-States for testing its suitability in these places. Its distribution to the cultivators has, however, been withheld for the present on account of the 'grow more food' campaign.

In order to further improve the staple length of *bhoj cotton 43* a large number of crosses between *bhoj cotton 43* and *jarila* have also been made and the work is still in progress.

Improvement of American cotton

There are areas, though limited, where American cotton is grown as a pure crop. Work for the improvement of American cotton was started as early as 1924 and, as a result of single plant selections, a strain known as *Indore 1* was evolved which gave encouraging results on light soils under irrigation. This strain is doing very well in Rajputana. Further selection in acclimatized American cotton was done in 1933 and a few selections, namely *M.U.3*, *M.U.4* and *M.U.8A*, were isolated and later on tested in varietal trials for several years at Indore and Badnawar (Dhar State) which is an

important American cotton tract of Malwa. As a result of these trials *M.U.4*, because of its good yield and high ginning percentage, was recommended to the cultivators.

A large number of crosses between the Institute selections and exotic strains from Madras and the Central Provinces have been made in recent years to improve the ginning outturn and lint length of *M.U.4* and the work is in progress.

Improvement of Nimari cotton

Nimar is an important cotton tract in Central India. As the soils and climatic conditions are different from those of Malwa, experiments for the improvement of Nimari cotton are carried out in Nimar itself with the cooperation of Dhar State in one of their farms in the tract. Several established strains from the Central Provinces and Bombay, along with the best local selections, were tried in the past, but *jarila* was found to be outstandingly better in all characters. Until a more satisfactory strain of *desi* cotton is evolved, *jarila* is being distributed in this tract and is already gaining popularity with the mill owners. Further selection work in *desi* material has given a few new strains which are being tested against *jarila* and the local *nimadi* for their yield, economic characters and wilt resistance.

USE OF DDT MUST BE CAUTIOUS

INDISCRIMINATE use of D.D.T. can be highly dangerous, according to Dr. C. H. Curran of the American Museum of Natural History. Dr. Curran was one of more than a dozen experts who spoke during a forum on the powerful, new insecticide at the opening of the 41st annual convention of the National Audubon Society. 'Eventually', Dr. Curran said, 'we will find that we have in D.D.T. just about the perfect insecticide. But meanwhile its indiscriminate use without proper knowledge can be just as dangerous as the atom bomb'. The speakers agreed that D.D.T. used over wide areas to kill off insect pests, if not carefully applied, could do great harm in killing insects beneficial to man as well. A couple of instances were cited in which D.D.T. was used improperly in apple orchards. It killed the insects harmful to the fruit but also killed those which would have pollinated the trees with the result that they either failed to produce or the crops were subnormal. Dr. Clarence Cottam of the Fish and Wild Life Service of the U.S. Department of the Interior, said that he regarded the pollination problem as one of the most serious to be considered in connection with the use of D.D.T. 'D.D.T. should be used only in areas where the importance of destroying certain insects will outweigh the loss of those insects which are beneficial to man', Dr. Cottam said. 'Its dosage should be kept to a minimum.' D.D.T. kills small fish that feed near the surface but does not appear to affect deep-feeding fish. On a stretch of island beach, between the Atlantic Ocean and Barnegat Bay, D.D.T. was applied last summer in a dose of one-half pound per acre. It fell about 75 feet off-shore and floated in. All mosquitos and flies were eliminated but two days later it was estimated that 200,000 small dead fish had been cast up on a nine-mile stretch of beach. Dr. Annand said he would recommend not using D.D.T. in dosages greater than one pound per acre. This amount, he believed, would not be detrimental to wild life. He said many scientists feared use of D.D.T. would disturb the 'balance of nature'.

"What is the balance of nature?" he asked. "It is my impression that nature is generally out of balance rather than in balance."—*U. P. of America.*

A PLEA FOR MORE MILLETS

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In the Presidency of Madras, rice is by far the most important staple food crop occupying annually over a crore of acres (27 per cent of the total area sown). A fair estimation puts that about 60 per cent of the population, rich and poor alike, have rice as their staple food. Despite this marked and signal importance of the crop, it is sad to observe that the province is an importer of the commodity to the extent of seven lakhs of tons annually, the bulk of our supplies being drawn from Burma. Recent war developments[1] have, however, completely cut off our supply lines from that country and created the serious problem of shortage of food.

Of the two courses open to meet this situation the one, viz. to increase the area under the crop, is seriously crippled on account of the limited irrigation facilities now available, for the crop has to be raised ordinarily under swamp conditions. The other course is increasing the yields of existing rice areas by the use of improved strains, better cultural methods and manuring. This course cannot completely and confidently be relied upon to give satisfactory results in a short time, as the supply of improved seeds is at present limited and better methods of cultivation and manuring demand capital investment, which the average ryot is reluctant to make. No doubt the various schemes initiated by the Provincial Government and assisted by the Imperial Council of Agricultural Research, to augment production will yield fruitful results, but it is doubtful whether in view of the difficulties mentioned above the results achieved will be sufficiently quick or adequate to meet the deficit. Hence the writer would commend the case for millets. For one thing, the millets are all dry drought-resisting crops and do not require any elaborate irrigation schemes to increase their production. For another, about 40 per cent of the population in the province are known to live entirely on millets and a small portion of the rest on a mixed diet of rice and millets. The latter may easily change over to a diet based completely on millets, while a fair proportion of the middle class, who are finding it increasingly difficult to afford a cent per cent rice diet, may be induced to take to a mixed diet of rice and millets. This change may be possible once the case for millets is properly presented to the public and their production suitably encouraged.

Millets—acreage and importance

While rice sustains 60 per cent of the population the remaining 40 per cent depend upon millets. The latter includes crops as sorghum (Tel. *jonna*, Tam. *cholam*, Hind. *jowar*), *Pennisetum typhoideum* (Tel. *gentelu*, Tam. *cumbu*, Hind. *bajra*), *Elusine coracana* (Tel. *chodi*, Tam. *ragi*, Hind. *mandal* or *okra*), and *Setaria italica*—Italian millet (Tel. *korralu*, Tam. *tenai*, Hind. *kangni*). An area of 13 million acres is grown in this Province with millets and this exceeds the area under rice by about three millions. There are several varieties among those cultivated in different tracts of the Presidency. Taking sorghum for example, the *periamanjal* of Coimbatore, *tella jonna* of Bellary district and *patcha jonna* of Kurnool are the favoured varieties in their respective tracts. In nearly 12 districts of the province millets are extensively cultivated and cater to the food requirements of a large population in those areas.

Nutritive value of millets

From the nutritional point of view wheat is the best of the cereals and rice the worst. The millets being much richer in proteins and fats than rice and adequately supplied with vitamins take an intermediate position between the two. The flour of *ragi* made into a porridge is a common and favourite dish of the poor and is very nutritious—almost comparable to wheat. Dr Aykroyd recommends the substitution of one-third of the rice consumed with millets to effect an increase in the intake of all essential food factors notably that of protein and vitamin B1. The lack of adequate supply of the latter in our food, consequent on the use of highly polished rice, has recently been found to be associated with a disease called beri-beri, which unless properly treated often proves fatal.

[1] The situation has to some extent improved now that hostilities have ceased.—Editor.

Advantages

Economic : Unlike rice, millets do not require heavy rainfall or water supply and in fact they thrive in areas of scant and precarious rainfall under improved methods of dry farming. Their degree of concentration in areas of low rainfall is seen from Table I given below :

TABLE I

Rainfall and cultivation of millets in different areas[1]

Districts	Rainfall in inches	Percentage of total area sown
Malabar and South Canara ..	131	2
Vizag and Godavari districts ..	40	13
Chitoor, Arcot and Chingulpet ..	39	29
Trichy and Tanjore ..	38	32
Kistna, Guntur and Nellore ..	35	37
Madura, Ramnad and Tinnevelly	30	37
Coimbatore and Salem ..	30	55
Bellary, Kurnool, Cuddapah and Anantapur ..	25	54

The cost of cultivation of any one of these crops is far less than that of rice which is an advantage of considerable value. The crop yields and the net returns therefrom are satisfactory and remunerative for the small capital invested and the labour spent on production, during seasons of normal and well-distributed rainfall.

Mixed cropping : Millets are admirably suited to be mixed crops with pulses and other food crops. In combination with horsegram, groundnut, etc. their performance is beneficial to the soil and economical to the farmer. The dry land farmer of the Ceded districts is a good specimen of his kind and to him mixed cropping is a time-honoured practice. The farmer is able to produce most of his food requirements by growing millets and pulses together in his small and limited holdings that do not ordinarily permit the raising of them separately. There is saving in land and labour and, in addition, the cost of cultivation is at its minimum.

Pests and diseases—few: Further the loss of these crops through pests and diseases is relatively small as compared to rice and even the few are easily controlled. The Department of Agriculture, Madras, recommends an economical and practical method[2] of the treatment of seeds with sulphur as an effective remedy against an important disease, viz. short smut, which sorghum and Italian millet are often subject to. The millet grower can ill afford to ignore this simple but efficacious remedy at such a low cost of six pies per acre so as to save the huge loss of the grain through the disease. Further, experiments conducted in the Central Provinces have conclusively shown that if the seeds of sorghum[3] are treated for seed-borne diseases before sowing, not only is the disease checked but the yield also is increased.

Fodder value : The millets are to be considered as dual purpose crops in that they provide a nutritious food grain to the farmer and a bulkier fodder, much better than rice straw, for the cattle. In our country, where cattle power is the mainstay of all agricultural operations farmers could ill afford to ignore the importance of their adequate feeding and management. The green maize fodder for milch cows, the straw of sorghum and *ragi* for work cattle are considered to be palatable and nutritious fodders in south India. Further sorghum, maize and *ragi* can profitably be converted into silage which ensures green fodder to cattle at a time when no other green fodder is ordinarily available. The cost of production of 600 lb. of sorghum silage comes to a rupee.

Industrial uses of millets

The work of the chemical section of the Department of Agriculture, Madras, has shown the possibilities of utilizing sorghum for industrial purposes. The malt of commerce is obtained from barley the cultivation of which in south India is rare. Norris and Viswanath[4] reported the first favourable results of their investigations on the possibilities of successful replacement of barley by millets, notably *cholam* and *ragi*, in the preparation of malt. But of the two, *cholam* was undoubtedly found to be better. Later Viswanath and Suryanarayana were the first to demonstrate the semi-industrial possibilities of malting of *cholam*. The resulting malt foods compared quite favourably with many of the imported articles of the market. Besides, they have also indicated simplified methods of the process for

[1] Figures have been compiled from *Season and Crop Report of Madras*, 1939.

[2] *Leaflet* No. 43

[3] *Indian Farming*, Vol. II, 425

[4] *Agricultural Journal of India*, XVIII, 362–372

adoption in houses as well as in cottage industry. The chain of processes involved is so simple that even our rural folk could easily grasp it without much technical skill.

In addition, the short course at the Agricultural College, Coimbatore, includes training in malt making covering a period of three weeks every year since 1936. Annually on an average about 20 students coming from various parts of the Presidency take the benefit of the course.

The matter received an impetus in the year 1935 through a special grant for a scheme of research on the subject by the Imperial Council of Agricultural Research. The results achieved therefrom have been very encouraging and the foods prepared at Coimbatore have been put to practical and clinical tests in 27 Government and private hospitals. The opinion pronounced by all has been unanimous in that *cholam* malt is a good substitute for the imported malt foods, especially for the convalescent and the invalid. A beverage of malt is relished by patients with as much delight as a cup of ovaltine or cocoa. The favourable medical reports cleared all doubts and encouraged their wide use. In recent years malt making has established itself as a cottage industry in rural areas, as for example in Chitoor district, mainly due to the efforts of the Department of Agriculture, Madras. In the year 1942, the Provincial Government having recognized the value and intrinsic merit of the *cholam* malt, sanctioned the establishment of a malt factory at the Agricultural College, Coimbatore. Its present productive capacity is 1,00,000 lb. of malt per annum. The preparation of malt extracts with and without shark liver oil is a further development of the industry. The preparation of malt extract of good quality having proved a success in the laboratory of the Agricultural Chemist, a pilot plant for its preparation on a large scale was set up in February, 1942, and towards the end of the same year a plant designed to produce 1,00,000 lb. per annum of malt extract was set up. Both the malt and malt extract are popular and their demand is on the increase.

Few are aware that Madras alone annually imports malt foods to a value of 18 lakhs of rupees. At present about five million acres are devoted for *cholam* in Madras. This new industrial use of this millet will, it is hoped, give an impetus to increase the area under the crop.

Research—improvement of millets

Agricultural research devoted to the benefit of the dry land farmer has been in progress in Madras under two important directions. The task of evolving high-yielding strains of crops falls to the share of the plant breeder. The search for better agronomic and cultural practices to increase the yield through different cropping methods is the work of the agronomist. The first attempts to improve millets of this province was taken up in the year 1923 with the opening of a separate Millets Breeding Station at Coimbatore. Of the millets *cholam*, *ragi*, *cumbu* and *korra* received their first attention. In addition to the essential economic achievement, the work of the station included a fundamental study of each crop in detail with a view to collect complete data bearing on the crop. In collaboration with this station which functions even to this day as a central and guiding station, work is in progress at the Agricultural Research Stations of those districts in which millets take an important place among other crops. A large number of strains of these millets have been evolved and efforts are being made to replace the local varieties. Table II sets out the various strains of these millets and the districts where they have been popular and have proved to be of great value to the farmers. In general the yields were significantly higher (10 to 15 per cent) than the local ones, the quality being invariably superior. The higher yields, better quality, earliness and uniform maturity of the various strains are definite advantages which no intelligent farmer can fail to recognize.

TABLE II

Popular strains of millets in Madras

Northern Circars

District	*Cholam*	*Ragi*	*Cumbu*	*Korra*	Remarks
Vizag		525 BBL 5 VZM 8 VZM 33 EC 593	Poonaganti		Work on millets is in progress at A.R.S.[1] Anakapalli.
Guntur	J 103 (Pyru) J 869 (Punasa yellow) J 916 (Punasa red)		PT 700	K 6	Work on millets is in progress at A.R.S., Guntur

[1]A.R.S.—Agricultural Research Station

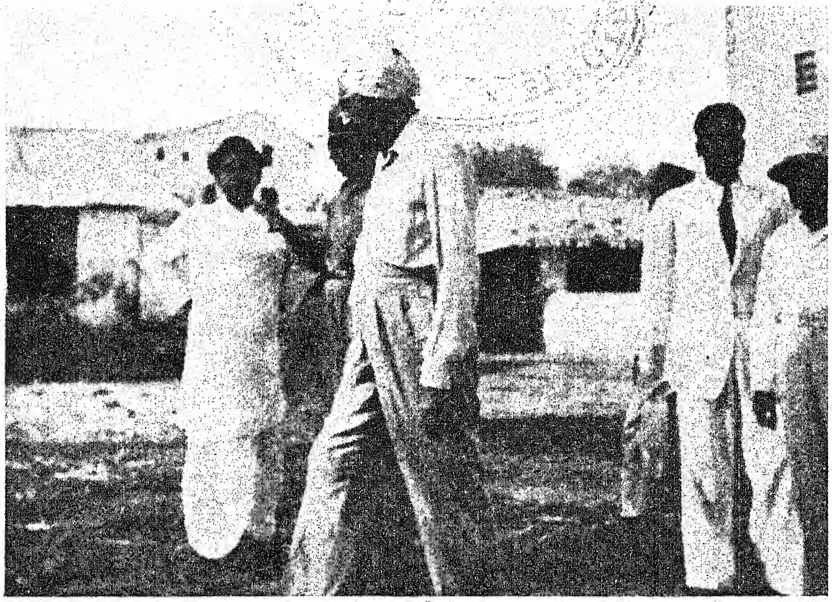

FIG. 1. At Karachi Panjrapole—Rambag Branch
L. to R. Seth Jethanand Hiranand (President Karachi Panjrapole),
Mr. Zal R. Kothavalla, S. B. Sir Datar Singh

FIG. 2. Discussing Milk problem with *maldars*
L. to R. Mr. Zal R. Kothavalla, S. B. Sir Datar Singh, R. B. R. L. Sethi

PLATE 15

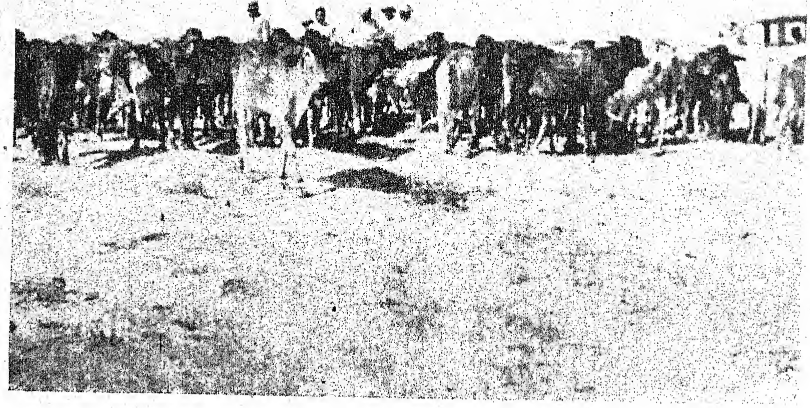

FIG. 1. Dry stock at Songal : Karachi Panjrapole out-station

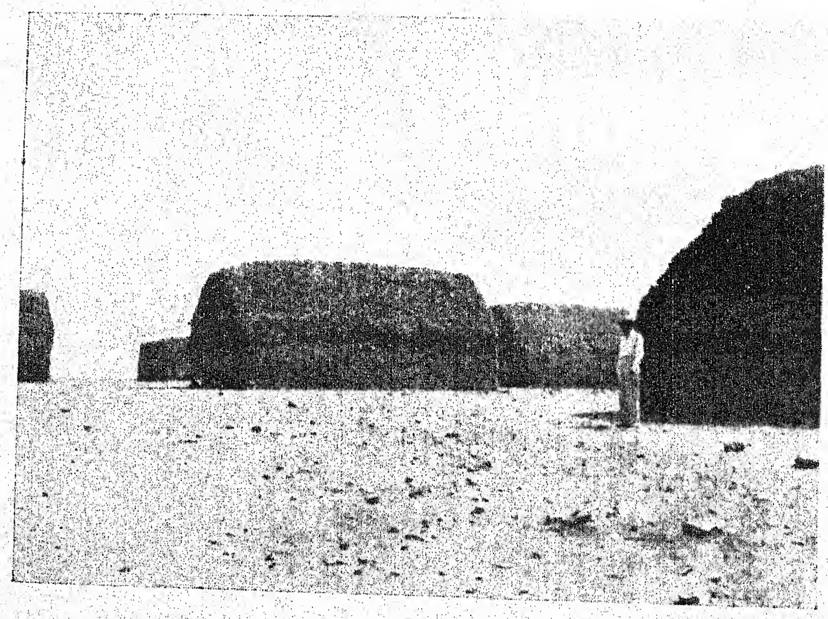

FIG. 2. Dry grass stacks at Babrana : Karachi Panjrapole out-station

PLATE 16

Ceded districts

District	*Cholam*	*Ragi*	*Cumbu*	*Korra*	Remarks
Kurnool	T 6 N 28/38 N 29/68 N 223 N 224			K 132 K 140 of Nandyal K 6 of Guntur	Millets work at A.R.S., Nandyal
Cuddapah	N 28/3 N 29/68			K 132 & 140	
Bellary Anantapur	T 1 & 12 (*tella jonna*)	EC 593 R 42		K 23 & 68	Millets work at D.F.S.,[1] Hagari
Central districts					
Chitoor	AS 3313	EC 3517 593 H 22	PT 700 367		
Chingulpet	1093 J 103	EC 3517 593 3735	PT 367 700 229		
South and North Arcot		EC 593 3735	PT 700		
Southern districts					
Trichinopoly	AS 2095 389	EC 3517 593	PT 700		
Tinnevelly and Ramnad	2095	593	PT 8 105		Millets work at A.R.S., Koilpatti
Madura	2095 46	593	PT 105		
Coimbatore and Salem	AS 29 809 1543 1575 2095	EC 593 3517 3735	PT 700 367		Millets Breeding Station, Coimbatore

Millets—dry farming

Dry farming is a subject of great importance, as large areas in the provinces of Bombay, Madras, Hyderabad and Punjab which, more often than not, are dependent entirely on the rainfall received. In such areas the dry and drought-resisting millets form one of the chief crops. In view of the wide importance and absolute necessity of the problem, the subject has engaged the serious attention of the Imperial Council of Agricultural Research ever since 1930. In the chain of research stations that the Council has subsidized, the Dry Farming Station, Hagari (Madras), is a link. Its scope of investigation covered four important aspects of the problem, viz. (i) soil physics, (ii) plant physiology, (iii) agronomy and (iv) crop improvement.

The chief items of work under investigation on the side of soil physics are the study of moisture condition of the soil under various agronomic practices at different periods of the year and the loss of soil and water due to erosion. The main results of these investigations are that the soil lost by erosion is much richer than the soil left in the field and that the success of a crop practically depends on the maximum depth to which the rain water penetrates and the water-holding capacity of the soil.

In plant physiology, studies on root development of *korra* (Italian millet) at different stages of growth and the anti-erosion values of crops were the chief items that engaged the attention of the research workers. The results indicated that the root development is entirely dependent on the availability of moisture and manure supplied. The Italian millet, pure or in a mixture with cotton, groundnut or horse-gram was found to check erosion to certain extent.

Under agronomic experiments bunded plots yielded 23 per cent more cotton and 115 per cent more sorghum grain than unbunded plots. Attempts to evolve strains of shorter duration and drought-resisting ones are in progress under the items of crop improvement.

Conclusion

The dry land farmer with his mixed crops of millets and pulses can always be self sufficient and at the same time command a nutritionally well-balanced diet, if only he takes the trouble to raise a few vegetables and does not ignorantly exchange his millets for the polished rice. The strong physique of those whose mainstay is millets is well known even in the present day. The task of dispelling ignorance and prejudice about millets rests heavily on the shoulders of all those interested in rural welfare. In view of the multifarious advantages of these crops over rice, particularly in south India, one can realize the urgent necessity for their increased production as an item in the 'grow more food' campaign. Increasing the area under

[1] D.F.S.—Dry Farming Station

millets will go a long way to successfully solving the present shortage of food.

Acknowledgements

I take this opportunity of acknowledging my indebtedness to Sri H. Shiva Rau, B.Sc., Dip. Agri. (Cantab.), A.I.C., Government Agricultural Chemist, for his constructive criticism and valuable suggestions. My thanks are due to Sri C. Vijayaraghavan, Millets Specialist, for allowing me the use of illustrations on millets.

THREE CATEGORIES OF SOVIET FARMS

At present Soviet farms belong to one of three categories—Individual farms; Collective farms (Kolkhoz or artel); and State farms (Sovkhoz), writes L. Lorinez in the *Economic Annalist*, issued by the Economics Division, Dominion Department of Agriculture. A State farm (Sovkhoz) is owned by the State and farm employees of the State are civil servants. At the outset, the State farm in the U.S.S.R. served as a model for the organization of collective farms and to acquaint peasants with the operation and advantages of large-scale farming methods. At present the State farms operate along more specialized lines of research and demonstrate the practical application of scientific progress on a large scale. State farms are not primarily operated for output or profit like the collective farms. By the year 1940, a total of 99·9 per cent of all peasant farm lands was consolidated in collective farms in the Soviet Union, but collectivation was a gradual process with several types existing prior to 1935. In that year all farm representatives held a congress at which 'The Model Statute of the Collective Farmers' Artel' was promulgated and became obligatory for all collective farms. Any agricultural enterprise which is not a State or individual farm is a Kolkhoz or collective farm. The land belongs to the State, but a grant for its use in perpetuity is given to the collective farm by the Government. The following are common property—draft animals, farm implements, seed, fodder for jointly owned live stock, farm buildings, processing plants. The non-socialized private property for members of the Kolkhoz is composed of—a plot of land ($\frac{3}{8}$ths to $2\frac{1}{2}$ acres) adjoining the dwelling; the dwelling itself; live stock not exceeding one cow, two calves, two sows with litter, 10 sheep or goats; 20 beehives, and any number of rabbits and poultry. These numbers are increased considerably in case of specialized live stock farms or under nomadic pastoral conditions. The socialized property of Kolkhoz members is estimated at cash value. From 50 to 75 per cent of this value is considered the collective farmers' share. The balance is paid into the Kolkhoz sinking fund, in addition to an entrance fee collected from every collective farmer. Children are taken into the Kolkhoz as full members at 16 years of age. If a farmer wishes to withdraw from the Kolkhoz, his share is paid back to him, but he is entitled to receive land elsewhere if available. Individual farms on the Soviet pre-war territory are found only as small isolated holdings in remote areas where collective action is not possible. Individual farms are found almost exclusively in the new Soviet territories of the three Baltic countries; also in Karelia, Bessarabia, Bukovina, and the former polish Ukraine.—*Department of Agriculture, Canada.*

DIPPING SHEEP IN LIME AND TOBACCO MIXTURE

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Hosur taluka can be said to enjoy a temperate climate. Sheep in these parts are badly affected with several kinds of external parasites, such as lice, ticks, mites, etc., and a periodical dipping of sheep against them is a necessity in the interests of both wool and mutton. The practice of dipping sheep 3 to 4 weeks after every clipping against these external parasites was strictly adhered to ever since sheep breeding was started on this farm. Among several kinds of preparations found in the market the two popular products, namely 'MacDougall's non-arsenical sheep dip' and 'Coopers arsenical sheep dip' were used on this farm until recently. These foreign products are not easily available in the market at present. A necessity has therefore, now arisen to find out a suitable substitute.

Lime and tobacco mixture

It was realized that any local product when prepared must be within the reach of an ordinary ryot or a shepherd and that its constituents must also be readily and easily obtainable in local markets. Hence a mixture of the two most common insecticides, viz. lime and tobacco, in the proportion of 1 : 3 in 3 per cent solution with one ounce of washwell soap in every 10 gallons of mixture was tried this season on a few sheep with good results. Soap was merely intended to serve as an adherent to the wool for some time, while the first two served as insecticides. This was tried both in the laboratory and in the field and found quite effective against sheep lice and ticks. It could not be tried against sheep-scab, as it was not prevalent either on the farm or in the nearby villages.

Constituents of the mixture

A solution of 110 gallons of this mixture is found necessary to provide a convenient dip in a small vat and this, when prepared, can be effectively used for dipping not less than 200 sheep before getting soiled. The following are the ingredients required for preparing this mixture.

Lime	8 lb.
Washwell soap ..	11 oz.
Tobacco	24 lb.
Firewood	2 cwt.

Stock solution : The 24 lb. of tobacco was cut into small bits and steeped in 24 gallons of warm water for 24 hours. This was then boiled for two hours. Water was added when necessary to make up the loss due to evaporation. This was then removed and allowed to settle for six hours. The leaves were then rinsed and removed. The 8 lb. of lime was then taken and first made into a paste by adding a little warm water and then mixed in 8 gallons of clear water and boiled for half an hour in a separate earthen vessel. The unslaked particles were then removed and the liquid added to tobacco solution. Washwell soap (11 oz.) was then boiled in 1 gallon of clear water in a separate vessel and was added to the original mixture. The mixture of all these three, viz. 8 gallons of lime-solution, 24 gallons of tobacco solution and 1 gallon of soap solution, making a total of 33 gallons, was again boiled for two hours in a big vessel, stirring the liquid often to prevent caking at the bottom. This was then removed and allowed to settle for 12 hours. The supernatant fluid was then drawn out and kept as stock solution.

Trials

Live ticks and lice were collected from sheep and tested in this solution at the laboratory under various strengths and found that a 3 per cent solution of the mixture killed these parasites in about 1½ minutes. One hundred and ten gallons of this 3 per cent solution was then prepared in a vat and used for dipping sheep. Fifteen sheep were dipped in this solution and examined both before and after dipping. They were allowed to remain in the bath only for about 1½ to 2 minutes, and no bad effects of any kind were noticed after dipping. They were again examined after two hours and a few lice were also collected from

them and examined: all were found dead. These 15 sheep were then kept under observation for about a month. Both strong and weak sheep of both sexes were tried in this solution. All stood the test well and no harmful effects of any kind were observed during the period.

Cheap cost of production

The cost of this local preparation when compared with that of the foreign products, at pre-war rates, is also in favour of its acceptance.

The cost of dipping 200 sheep is given below:

	Pre-war rates Rs.	Present rates Rs.
1. Lime and tobacco mixture		
Cost of 24 lb. of tobacco	6– 0– 0	30– 0– 0
„ „ 8 lb. of lime	0– 4–11	0– 6– 5
„ „ 2 cwt. of firewood	1– 0– 0	1– 0– 0
„ „ One bar soap	0– 3– 8	0– 6– 2
Total	7– 8– 7	31–12– 7
2. Cost of 6 packets of MacDougall's non-arsenical sheep dip including freight ..	12–11– 0	24– 5– 0
3. Cost of 6 packets of Cooper's arsenical sheep dip including freight	—	19– 5– 0

The present cost of tobacco is very high (it is five times the pre-war rate) and hence, this may appear a little more costly at present than the foreign product. Being a local product, the cost of tobacco, however, may be expected to come down to the pre-war rate, if not lower. All the materials are readily and easily available in the local markets and the preparation also does not require much technical skill.

It will be interesting to try this on a large scale and to make a more detailed study with regard to its action on the growth and quality of wool, its effects on sheep-scab, cattle ticks, ringworm, etc. and also to find out the extent of its deterrent capacity against further infection when once treated. The possibility of further concentration of the stock solution to facilitate easy transport is also to be studied.

AUCTION SALES OF PEDIGREE CATTLE

THE All-India Cattle Show Committee are sponsoring auction sales of pedigree cattle. The first will be held at Delhi on 21 March 1946 on the Ram Lila grounds outside Ajmeri Gate and will commence at 10 a.m. The stock presented will be Sahiwal and Hariana cows, young bulls and heifers and Murrah buffalo cows.

The second sale will be held at Amritsar on 19 April 1946 at the Cattle Fair grounds (a mile from the city on the Grand Trunk Road) and will also commence at 10 a.m. In this sale Sahiwal and Ravi buffalo cows, young bulls and heifers will be presented.

All lots are specially selected and should make good basic breeding stock. A catalogue containing full particulars of the animals can be obtained from the undersigned on payment of Re. 1.—A.I.C.S.C.

FRUIT PLANT NURSERIES

Khan Bahadur Nizamuddeen Hyder

Ex-Director of Agriculture, H. E. H. the Nizam's Government, Kakori, Lucknow

WHILE it is recognized that a substantial increase is needed in the production of food to adequately feed the population of India, it is also agreed that a great deal of improvement is required in the quality of the food. One of the necessary steps for improving the quality is increasing the production and consumption of fruits. Necessary improvements should be made in the existing orchards so as to increase their output and new orchards should be brought into being. Millions of fruit trees will be required for this purpose. The trees should possess the desired characters, i.e. they should be high yielders of nutritious fruits. Arrangements should be made for adequate production and supply to prospective fruit growers of reliable plants of approved varieties.

Responsibility of nurserymen

A number of nurseries exist in different parts of India which supply fruit plants to the public, but very few of them can be said to be reliable. Apart from carelessness on the part of many nurserymen, the craze for maintaining a large collection of varieties of the same kind of fruit is largely responsible for giving a bad name even to careful nurserymen. Nurserymen offer and supply plants of all the varieties that they have. Very often it happens that a purchaser obtains plants of a particular variety from one of these nurseries and puts them in his orchard, but after four or five years when those plants bear fruit he discovers that he had been supplied with plants of a wrong variety. The purchaser of the plants feels that his time and money have been wasted and the seller gets a bad name. There are so many chances for occurrence of mistakes that even an honest nurseryman may commit mistakes unknowingly by supplying plants of wrong varieties. The maintenance of purity of varieties is a difficult matter. It requires extraordinary precautions and elaborate and expensive arrangements, which it is not possible for all nurserymen to provide.

Necessity of Governmental support

The production and supply of such a large number of plants which are true to type cannot satisfactorily be done without organizing the plant propagation industry on proper lines. A scheme for such an organization is suggested in the following. The Government has some nurseries in different parts of the country, and it may establish some more. They can afford the necessary elaborate and expensive arrangements, and can produce plants which are strictly true to type. These nurseries should serve as centres for the production of plants specially for private nurserymen, as distinct from fruit growers. Private nurserymen should obtain nucleus stock from the Government nurseries, and they should use those trees only for propagation for supply to the public. They should work in cooperation with the Government and under their guidance and control. They will gain by doing so. If a nurseryman keeps only genuine and healthy mother plants in his nursery, labels them properly, limits propagation from these trees only, labels the nursery stock properly, sells only fresh and healthy plants and complies with other similar conditions that may be laid down by the Government, he can obtain support from the Government by getting his nursery registered. He will become a licensed nurseryman. Would-be fruit growers will naturally prefer to purchase plants from him, knowing that his supplies are really reliable. Nurserymen will benefit by getting their nurseries registered and fruit growers will benefit by getting good and reliable stock. The Government, should, therefore, encourage the establishment of a large number of registered nurseries. These nurserymen also will have to make the necessary elaborate arrangements for the production and supply of reliable plants, because of the existence in their nurseries of more than one variety of the same kind of fruit. The number of such nurseries will, therefore, remain limited and will not be able to satisfactorily meet the demand for plants for the whole country.

One variety nurseries

A simple kind of nursery can also be established. Those who cannot afford to make

elaborate and expensive arrangements, can establish what may be called 'one variety nurseries'. Only one variety of one kind of fruit should be kept in the nursery and propagated. No other variety of the same kind of fruit should be planted or allowed to remain in the nursery. For instance, one wants to establish a mango nursery, and he finds that there is a great demand for plants of *dasehri* variety in his part of the country. He should obtain good and reliable plants of *dasehri* variety from a Government nursery. He should put these plants only in his garden and he should not plant any other variety of mango. From these trees only he should propagate and produce plants for sale. He need not put labels either on the mother trees or nursery stock, and he need not make expensive arrangements for maintenance of purity in his stock, because there being no other variety of mango in his garden there will be no danger of mistakes or mixing. As he will concentrate on *dasehri* only and will give all attention to the same variety, he will gain a great deal of experience, and in course of time, he will become an expert in *dasehri* variety. He will be able to produce extraordinarily good plants of this variety, better than those produced by those nurserymen who keep many varieties of mango. He will gain a reputation in *dasehri*. The lovers of *dasehri* will always purchase plants from him.

If it is considered that by concentrating on one variety only the business will remain limited and will not yield sufficient income, production and supply of plants of one variety of some other kind of fruit may also be undertaken at the same time. For instance, instead of having six different varieties of mango only, the nurseryman can have one variety of mango, one variety of orange, one variety of guava, one variety of banana, one variety of grape and one variety of sapodilla and so on. Thus, he can specialize in the production of plants of a single commercial variety each of as many different kinds of fruits as he can grow and propagate successfully. No special precautions will be needed to ensure purity of the plants produced. Such 'one variety nurseries' should be established in large numbers all over the country, so as to produce sufficient number of plants and to reduce to the minimum the cost of transport and death of plants in transit. If one nurseryman undertakes the production of plants, say of *dasehri* variety of mango, *sangtra* variety of orange, Allahabad *sufeda* variety of guava, *champa* variety of banana, *fakhri* variety of grape and round variety of sapodilla, another nurseryman in the same district can undertake the production of plants say of *langra* variety of mango, *mosambi* variety of orange, *habshi* variety of guava, *martaban* variety of banana, *sahebi* variety of grape and oval variety of sapodilla, and so on. Any number of such simple nurseries can be established without the danger of mixing of the varieties. These 'one variety nurseries' should also be registered for obtaining Governmental support and recognition so much needed for the success of the business. As such nurseries will mostly be established by persons of limited means and resources, they may need special kind of patronage from the Government. The Government should give them all possible encouragement and help, and, if necessary, grant them subsidies for a few years in the beginning, until they are able to stand on their own legs.

ECONOMICS OF HAY PRODUCTION

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HAY is one of the best forms of nutritive roughages that can be fed to livestock. Hay should be differentiated from straw and dried grass. The green grass becomes hay when it is dried, cured and partially fermented in stacks. Good hay must be free from dirt, must have an agreeable sweet smell, light greenish in colour and should be composed of fine richly cultivated grasses. The out-turn and quality of hay largely depend on the grass having been cut at the proper stage, i.e. when the bulk of the grasses are in flower. If the crop consists of mixed grasses, some grasses may flower earlier than others. In order to guard against this, it is essential to put the crop back by repeated cuttings. During breaks in the monsoon hay can be made on a limited scale but it is always better to regulate hay-making when for a reasonable length of time good weather is expected. Rain affects the quality of hay.

Procedure

The grass intended for hay-making should be cut with mowing machines. The advantage of using mowing machines are: (1) there is no risk of dirt being introduced into the hay, (2) on a large farm the whole crop can be cut at the proper time, and (3) yield of grass will be more. The mowing machines cut the grass and leave it on the ground in swaths. These swaths should be opened and exposed to the action of sun and air. For this purpose hay tedders can be used. Hay tedders obviate much handling and tossing of grass, but at the same time brings about uniform curing. Excessive tedding will result in most of the foliage dropping off the stems and as such two or three tossings are enough to get both sides of the hay uniformly exposed to sun and air. The tedded hay can conveniently be raked into rows by hay rakes. The raked hay should be put into conical-shaped cocks. The hay can remain in cocks from two to seven days or until such time as it becomes convenient to stack. This allows a slight fermentation before stacking and the dryage of any grass cocked in a moist state. The advantages of cocking are: (1) action of rain and dew on the soluble ingredients of the hay is limited and (2) cocked hay retains its aroma, colour and weight. Stacking is necessary not merely for storage but to admit of the dried grass being converted into hay after sweating. Stacks should be built on a raised ground centrally situated to the area in which the grass is cut, nearer to a road to facilitate carting and away from buildings. All stacks should not be built in one place to avoid the risk of fire. The hay can be stacked on the ground itself built up to 10 ft. with the aid of hay forks after which height a hay elevator can be used to lift up the hay.

Factors affecting hay production

To produce good hay economically one should have experience. Strict supervision of labour and frequent examination of the grass at different stages of hay making are the two factors which determine the quality as well as the cost of production of hay. During hay making all available labour should be diverted to this work and the labour should be judiciously distributed for the different processes of hay making.

Cost of production

At the Livestock Research Station, Hosur Cattle Farm, hay is made annually out of about 800 acres. The bulk of the area in the Farm is covered with spear grass (*Andropogon contortus*). The cost of production of one ton of spear grass hay is detailed hereunder.

The area of the paddock	19 acres
Total yield of hay produced	51,500 lb. (40,000 stacked hay and 11,500 loose hay, i.e. 2nd racked and scythed grass from bunds)
Average yield per acre for this paddock	2,700 lb.
Approximate cost of production of one ton of hay	Rs. 13

Details

I. *Maintenance and upkeep*			
Cost of 190 cartloads of farmyard manure at Re. 1 per cartload	Rs.	190	0
Loading and spreading charges		10	0
Passing chain-harrows six cattle pairs at Rs. 1–8 per pair		9	0
Passing grubbers by six cattle pairs at Rs. 1–8 per pair		9	0
Weeding charges four times a year (weeding gang consists of one adult cooly at 8 as. and 16 boys at 2 as. each)		10	0
II. *Hay making operations*			
Combing spears from spear grass (by five pairs at Rs. 1–8 per pair)		7	8
Cooly charges for collecting awns and spears		2	0
Mowing grass by $7\frac{1}{2}$ cattle pairs at Rs. 1–8 per pair		11	4
Teddering the cut grass by 2 cattle pairs at Rs. 1–8 per pair		3	0
Raking hay by 3 cattle pairs at Rs. 1–8 per pair		4	8
Cocking raked hay by 18 adults at 8 as. per adult		9	0
Pulling the cocks to the stacking area by 13 cattle pairs at Rs. 1–8 per pair		19	8
Stacking hay by 24 adults at 8 as. per adult and $1\frac{1}{2}$ cattle pairs (i.e. three) for working the elevator at Rs. 1–8 per pair		14	4
Miscellaneous sharpening charges, greese oil, etc.		1	0
Total		300	0

Total yield of hay = 51,500 lb.
Cost of production of one ton of hay = Rs. 13

MANUFACTURE OF FRUIT AND VEGETABLE PRODUCTS

To provide for the manufacture of fruit and vegetable products under hygienic conditions and in accordance with the prescribed standards of quality, the Government of India have issued a Fruit Products Control Order devised in consultation with the Provincial Governments and fruit preserving associations. The standards laid down have been unanimously approved by the All-India Fruit Preservers' Association wihch has decided to enforce them by voluntary agreement till the Order comes into force. It is hoped that, as a result, the reputation of Indian fruit products may not suffer and inferior adulterated or deleterious products may not be placed on the market.

The order provides for the licensing of manufacturers and sellers of fruit products (such as fruit juices, tomato ketchup, jams, jellies, pickles and fruits and vegetables preserved by dehydration) in British India and shall come into effect in its entirety from March 1, 1946.—*Indian Information*, January 15, 1946.

What the Scientists are doing

JASSIDS IN COTTON

Among the major insect pests of cotton, the jassid (*Empoasca devastans*), a sucking insect, is an important one. While it attacks all cottons, Asiatic or American, it is the latter, *Gossypium hirsutums* which suffer most whether grown as an irrigated crop as in Sind, the Punjab and parts of Madras or as a rain-fed crop as in the Central and Peninsular India. Among these, the Cambodia cotton of south India is the only variety that has been found to be resistant to the jassid, all others being susceptible to it to a greater or less degree. In fact, in several tracts no *hirsutum* cotton which has not got at least some resistance to the jassid has any chance of success.

Insect infestation

The nymphs which hatch out of the eggs laid by the insect in the leaf veins on the under surface suck away the leaf sap resulting in crumpling, reddening, browning and final withering of the leaf tissues. The life cycle of the insect is short and as the insect does not hibernate, several generations are passed through rapidly resulting in rapid multiplication of the population. The insect can tide over adverse climatic conditions and there are several alternative hosts on which it can thrive when there is no cotton in the field. Extensive investigations on the insect by the Cotton Botanist in the Punjab have shown that in the jassid-susceptible varieties, infestation by the insect causes reduction in the growth of the main stem, in the number of flowers and bolls produced and also affects the fibre quality of the lint. Since control of the insect by chemical means under field conditions is neither practicable nor economical, breeding for jassid resistance appears to offer the only hope of combating the pest.

Jassid-resistant varieties

Among the morphological differences in cotton varieties that make one variety more susceptible to the insect than another, hairiness of the leaf is considered to be the most important. In South Africa where also the jassid is a very serious pest on *hirsutum* cotton and where breeding is in progress to evolve jassid-resistant varieties, they are devoting considerable attention to the hairiness of the leaf. It has, however, to be stated that while practically all jassid-resistant varieties are comparatively more hairy, all hairy types are not always resistant. Since the studies of the Punjab Cotton Botanist have shown that the main difference between comparatively resistant and susceptible varieties could be traced to the number of eggs laid in the leaf veins, it is considered that the thickness of the cuticle over the leaf veins might show differences and this point is still under investigation in the Punjab.

Incidence of the insect

In Central India where the American cotton is grown mainly as a rain-fed crop, the question of breeding for jassid-resistance has been receiving attention during the last three seasons. In areas in which cultivators usually grow American cotton as a mixture with the *desi* cotton (*G. arboreum*), the incidence of jassid on the American component in the mixture is either not serious or does not attract sufficient attention. In fact, experiments that have been conducted at Indore do point out that while the incidence of the jassid in pure American cotton is very severe, growing it mixed with the *desi* offers it a slight protection against the insect. While the incidence of the insect is a constant feature from year to year, the severity of the same is mainly dependent on the time at which the crop is sown. Where facilities exist for growing the crop with the help of artificial irrigation before the onset of the monsoon, the crop either completely escapes the jassid or, even where the insect is present, the damage is very considerably reduced. When, as in general practice, the crop is sown after the onset of the south-west monsoon, which may take place any time from the third week of June to the second week of July, even a few days' delay in the time of sowing appears to make all the difference between the success or failure of the crop. It has been found that a late sown crop is attacked by the insect right from the seedling stage and, as a result, the plants get killed in large numbers. While under irrigated conditions as in Sind and the Punjab, where the jassid attack is most severe

in July-August, i.e. some time after the sowings, a mildly attacked crop might recover with subsequent irrigations, the crop in Central India, where the attack comes soon after the sowings, is never able to make any headway and grow normally. Observations on *G. hirsutum* varieties grown at Indore have shown that even the comparatively resistant varieties of Sind and the Punjab succumb badly here. While even the resistant Cambodia cotton of south India is slightly attacked under Indore conditions, certain other varieties, for example the Mysore Americans and certain selections from material obtained from Sind Land Development Company, have been found to be comparatively free from the insect.

Universal symptoms

The most characteristic and universal symptom of the jassid attack on the plant is the curling produced in the leaves and the amount of curling judged qualitatively appears to offer a reliable criterion of the severity of the attack. Three years ago some unselected mixed seeds of *G. hirsutum* were obtained from a local mill and sown as a rain-fed crop after the onset of the monsoon. The attack of jassid was very severe in that year and individual plants were scored qualitatively for jassid-resistance from the amount of leaf curling produced, and sown in the following year in a regular replicated experiment. Periodical observations were taken on the crop and it was found that while both the set of progenies, jassid-resistant and jassid-susceptible, showed the attack in the very early stages, the former group shook off the attack and grew normally after some time, while the latter group continued to suffer to an increasing degree. In fact, a large percentage of the plants in the latter group failed to produce any bolls. It has been possible now to establish pure-breeding jassid-resistant and jassid-susceptible progenies from the above material. While the two sets of progenies do show some slight difference in the amount of hairiness in the leaf, it is doubtful if the character could have been used to isolate the resistant progenies so quickly.

Time of sowing and jassid incidence

It was mentioned earlier that the time of sowing the crop made a considerable difference in the jassid incidence. To test this point, the established susceptible and resistant progenies were grown again on four different dates with a fortnight interval between two, two as a pre-monsoon crop with artificial irrigation and the other two after the onset of the south-west monsoon. The susceptible progenies showed the characteristic attack and leaf curling in all the sowings, though the pre-monsoon crop grew more vigorously and proved more productive than the post-monsoon one. Among the resistant progenies while some never showed any leaf curling in all the sowings, others showed slight curling in the later sowings only. There were also some among the resistant progenies which showed a slight curling in the early sowings but not in the later ones. A possible explanation for this latter behaviour is to be found in the fact recorded by South African workers that the development of hairiness does not occur at the same time in all the resistant progenies.

Jassid incidence in rain-fed and irrigated tracts

While varieties resistant or susceptible to jassid in a particular tract might show some differences when grown in a different tract, from the experience gained it can be stated that the relative differences are maintained wherever the crop may be grown. Since the jassid incidence appears to be relatively more severe in the rain-fed American cottons grown in Central India than in irrigated tracts, progenies isolated as completely jassid-resistant under Indore conditions should prove more valuable in breeding for jassid resistance in irrigated tracts. Moreover, these progenies are definitely very early as compared to Cambodia of south India which though jassid-resistant is very late maturing for conditions in Sind and the Punjab.—K.R.

POTATO

As a source of food energy potato occupies a prominent place combining growth-promoting and nutritive characters in which it is one of the best obtained from plant origin. It forms an indispensable part in the bill of fare of the poorer section of almost all European countries while rich or poor alike use it in some form or other.

In India also it is a diet prized by all but its acreage is still very limited being about 500,000 acres which records an increase of nearly 12 per cent over the pre-war acreage of 448,000 acres for this crop.

The areas suitable for its cultivation include most of northern India during cold weather and cooler areas of submontane tracts in the hills all over the peninsula.

The obstacle in the way of the extension of potato cultivation lies in the absence of varieties suited to different soils and climates, the heavy losses due to diseases and pests, the lack of healthy seed and the losses during storage. It is, therefore, necessary to focus attention towards:

1. Evolution of higher yields.
2. Production of pure and disease-free seed potato.
3. Control of diseases and pests.
4. Improvement of seed storage.

Before the Imperial Council of Agricultural Research came into being in 1929 the previous work was more or less of a sporadic nature. It mainly consisted of importation of exotic varieties or of some endeavour towards control of diseases in respect to crop or storage but there was little of a lasting character. Within three years of its formation, the Council initiated a scheme in Madras for the study of the more fundamental aspects but it soon became apparent that the problem required handling on a more comprehensive scale.

The Imperial Council of Agricultural Research, therefore, took steps for initiating:

1. A central potato breeding station at Simla.
2. An intermediate research station at Bhowali.
3. A seed potato certification scheme at Kufri.
4. A seed potato multiplication centre at Karnal.
5. A scheme for investigation of diseases and pests in Bihar.

The object of the Simla Station is to study varieties from India and abroad including materials received from Empire Potato Breeding Station; amongst its other objects are multiplication of most promising new varieties, study of problems connected with sterility, fertility and viability, selection of disease-resistant hybrids, virus diseases and so forth.

The Bhowali Centre was started to supplement potato breeding work carried out at the Simla Central Station and to act as a bridging station between the higher hills and the plains.

For the purpose of seed certification scheme, Kufri was selected as at this place the conditions for masking of adverse symptoms are least favourable for selection, certification and distribution on a meticulous basis.

The object of the Karnal Centre was to supply comparatively disease-free seed potato to growers whereas the name of the Bihar scheme is itself self-explanatory.

The work initiated in 1936 has already begun to bear fruit. Some very desirable hybrids since evolved have been tested in Assam and one of them is under large-scale cultivation. A new method of tuberless sowing from sprouts yielding 20 to 40 plants per tuber has been developed, which promises to be of inestimable value in the way of rapid multiplication of the desired strains.

Amongst the hybrids nine have been found superior to Darjeeling Red Round and six to Phulwa. In addition to these, considerable progress has been made in the breeding of late blight-resistant types.

A very interesting feature has been noticed in the dormancy of seed potato. The Simla crop which is harvested in July-August and is not suitable for planting in September in the plains of northern India was found to be suitable in southern India. There is a comparatively higher temperature in this part of the country during the months of September-October and there the tubers are cut and the crops irrigated copiously. These factors seem to shorten the period of dormancy.

At the Seed Potato Certification Station, Kufri, production of virus-free seed has made considerable headway and some promising materials have been selected from Darjeeling Red Round and Majestic. The Bihar work on diseases and pests shows that the potato moth can, in absence of exposed potatoes, lay eggs on leaves and even on soils. The larvae live as leaf miners or terminal shoot borers. If, however, there are cracks in the soil the larvae go inside but are not able to infest the tubers unless they are situated at depths of less than one inch. The highest rate of multiplication of pests occurs at a temperature between 86°F. and 102°F. This accounts for the heaviest damage between April to June. Free play of air and light as well as darkness reduce the viability of eggs. Dusk and diffused day light are more congenial for their maximum activity.

The control of the pest under field conditions lies in applying sufficient irrigation to prevent soil from cracking and in harvesting the crop when the plants are more or less green and are

about 3½ months old. At this stage they are less liable to the moth attack than later on when the leaves dry up.

Under storage condition losses can be appreciably controlled by storing tubers on the floor under sand about half an inch in thickness with some garlic during the months of April, May and June and transferring them to *machans* during the following three months.

Several pre-treatments of tubers have also been tried and treatments with phenyl, corrosive sublimate and *sinewani* leaf extract seem to yield best results.

Another interesting feature is the study of biological methods for the control of pests. A type of beetle has been found to be an enemy of the eggs and caterpillars of the potato moth. Work on this line is still in progress.

The help of ants has been found to be of great service. If *gur* or cheap sugar is sprinkled, the ants are attracted and incidentally they perform the job of cleaning the tubers from eggs and larvae of the potato moth without damaging the tubers.

Other investigations are directed towards improving the cooking and keeping qualities, maintenance of foundation seed stocks and so forth.—I.B,C.

MORE NUTRITIVE RICE

A MEETING of members of the Sub-committee of the Technical Research Panel of the Food Department dealing with vitamin technology, members of the Nutrition Advisory Committee of the Indian Research Fund Association and officials of the Agriculture, Food and Health Departments of the Government of India will be held in New Delhi to consider two processes which claim to yield better and more nutritive rice, and to make recommendations to the Government on their policy towards the new processes. The almost complete retention of vitamins in paddy even after milling, the virtual elimination of breakages in milling and the immunity secured against weevil infestation, which makes it possible to store rice without deterioration for indefinite periods, are some of the claims made for the 'Rice Conversion' process. It is also said that this 'converted' rice can be eaten immediately after harvest without the fear of digestive disorders usually associated with new rice, and even if overcooked, individual rice grains remain separate.

It is gathered that Mr. E. G. Huzenlaub the originator of the 'Rice Conversion' process is in Delhi, and will be available for consultation. The 'Roche' process, on the other hand, claims to be able to restore or even increase vitamins of the 'B' complex, lost in milling white rice! It is understood that the Hon'ble S. Butler, Commercial Adviser to the Food Department made a study of these processes, when he visited U.S.A. last year.—*B.P.I. Press Release,* January, 1946.

What would you like to know?

Enquiries regarding agriculture and animal husbandry should be addressed to the Directors of Agriculture and Veterinary Services in provinces and states. This section is reserved for replies to selected letters in cases where it seems that the information may be of general interest.

Q. I would like to know the details about the poisoning effect of feeding *Barawadi* grass to cattle. The grass grows wild in certain areas of Ajmer-Marwara.

A. The fodder grass *Barawadi* appears to be a poisonous grass at least at the early stages of its growth and to a great extent resembles the *jowar* plant. With the advent of monsoon rains, the plant grows luxuriantly with fine green leaves which attract the cattle and takes a heavy toll of their lives every year. Exact statistics of mortality due to poisoning from this grass is not available. The onset of poisonous symptoms and death are so sudden that the villagers find it well nigh impossible to call for the timely aid of a veterinary surgeon. As a form of quack treatment, the ears of the affected animals are generally cut longitudinally at two or three places without any good result.

Recently this grass was responsible for the death of 35 sheep and 2 cows in Rupaheli, a village near Beawar in Ajmer. The animals accidentally got access to the young plant while they were out for grazing. Almost all the animals that grazed this plant died in less than an hour before any veterinary assistance could be requisitioned. The animals showed symptoms of colic and tympanitis after grazing and died out of convulsions and asphyxia. The symptoms of poisoning resemble those of hydrocyanic acid and similar symptoms are observed in animals that graze young shoots of *jowar* plant.

Another report from the exact site of incidence records that the owner found his animals graze hardly four to five plants of this variety of grass at its early stage ; the poisoning symptoms and death occurred very suddenly.

The grass, when chemically examined in its young stage, was found to contain 26 mg. of hydrocyanic acid per 100 gm. and the quantity present was sufficient to cause the fatal results reported above.

A moist sample of the same grass which got mouldy in transit gave 16 mg. of hydrocyanic acid per 100 gm., a quantity somewhat lower than the former sample. This must be due to the hydrolysis of the cyanogenetic glucoside, the real source of hydrocyanic acid in the grass, and its subsequent decomposition, resulting in a loss of hydrocyanic acid. The latter sample in its original undecomposed state must, however, prove to be equally fatal as the former one.

Another sample of the grass was later on obtained in the flowering stage. Leafy portion was separated from the flowers, and both were submitted to chemical examination. It was found that the leafy portion contained 10 mg. of hydrocyanic acid per 100 gm., whereas the flowers had none of it. It has been found that the grass, when fed to the cattle in the flowering stage, is harmless. It would, therefore, appear that the hydrocyanic acid content of the grass decreases with its maturity. The feeding of the grass from the flowering stage to its harvesting period would not therefore have any deleterious effect on the cattle. The grass has been identified to be *Sorghum helepense* Pers. The above warning regarding its feeding to the cattle is given for the benefit of those who are likely to use this fodder grass in the particular areas where it grows wild.—S. Das.

What's doing in All-India

THE PUNJAB

CH. KARAM RASUL, B.Sc. (AGRI.) (PB.), ASSOC., I.D.I.
Associate Professor of Agriculture, Punjab Agricultural College, Lyallpur

An unusual cold spell of weather was experienced in April due to frequent showers of rain in the first half of the month and hailstorm in March. The temperature during May was also below normal on the whole, while the month of June was hot as usual. Light to moderate rain was received during May and June. Mean monthly temperatures recorded at Lyallpur for the quarter under report are given below :

	April	May	June
Mean maximum	89·97°F.	103·7°F.	109·3°F.
Mean minimum	62·47°F.	74·0°F.	80·03°F.

Wheat

The climatic conditions at the time of sowing of the crop being on the whole favourable, the area in the British Punjab, according to the second forecast, is returned as 10,053,800 acres against 99,38,000 acres, the actual area of the last year. The area in the Indian States, however, is 14,60,800 acres which is 11 per cent less than the actual area of last year. Rainfall in January was generally above normal and proved very beneficial to the crop. In addition, mild temperature and comparative absence of dust-storms at the time of grain development resulted not only in high outturn but the quality of the produce was also good. With the exception of the Ambala and the Karnal districts, shrivelling of grain was not reported from any other parts of the province. The average price of wheat in the Lyallpur market was Rs. 9 per maund which was lower by about annas fourteen per maund than that of the previous quarter but was almost the same as in the corresponding quarter last year.

Gram

The estimated area was 49,14,400 acres, i.e. 20 per cent more than the actual area of last year. Whereas rain during winter proved beneficial to the crop, that received in the beginning of April delayed harvesting. The crop was damaged to some extent by lightening in the districts of Gurdaspur, Sialkot, Lyallpur and Multan, by dust-storms in parts of Hissar, Rohtak and Mianwali, and by hail-storms in Mianwali. On account of these unfavourable conditions the outturn, though estimated at 968,100 tons or 15 per cent above that of the last year, was nevertheless commensurate with the increase in area. The average price of gram at Lyallpur was about annas ten and three pies per maund higher than that of the corresponding quarter last year and the last quarter respectively.

Barley

The area and outturn of barley are estimated at 844,100 acres and 218,000 tons respectively. The former is 11 per cent and the latter 6 per cent higher than those estimated last year. The winter rains proved useful to the crop but high winds adversely affected it in the Rohtak district. Harvesting of the crop was also delayed due to frequent showers of rain in the beginning of April.

Rabi *oilseeds*

Owing to the short supply of kerosene oil the price of oilseeds was expected to be higher during the quarter under review as compared to that of the last year but in the Lyallpur market the average price of *toria* remained about the same as in the corresponding quarter last year. This may be attributed to the prohibition of the export of oil and oilseeds from the Punjab except under a permit and also to a good crop of oilseeds of the rape group, the outturn of which has been estimated at 53 per cent higher than that of the last year.

Sugarcane

The crop being very remunerative in these days is gaining ground every year and is receiving the best attention of the farmer. The average price of *gur* per maund at Lyallpur

during the quarter under review is about a rupee higher than that of the corresponding period last year. The new crop has been reported to be attacked by red mites in some parts of the province but they have subsided with the advent of rains.

Cotton

The sowing of the crop was taken up quite in time but resowing of some fields has to be done in some parts of the canal colonies due to the damage done to the germinating crop by an insect locally known as *toka* (*Chrotogonous* sp.).

Tobacco

On account of the very high price (about Rs. 160 per maund) of tobacco last year, the crop attracted much attention of the farmers, many of whom have realized good income by its cultivation. A farmer is reported to have obtained Rs. 800 from one-fourth of an acre plot as gross income.

Miscellaneous

Jowar and bajra: Due to the control of the price of *bajra* and *jowar* in the Punjab, the movement of these seeds from surplus to deficit areas was not free. Hence the Department of Agriculture, Punjab, made special arrangements for its supply to the farmers. In addition to the usual activities of the Department of Agriculture, schemes in connection with the 'grow more food' drive, such as supply of big and small implements, distribution of seeds of green manuring crops free of cost, propaganda for composting of waste products, pushing of village poultry schemes and arrangements for surface-percolation wells, received special attention.

Fruits and fertilizers: An unusual phenomenon of the occurrence of frost in the first week of March resulting in a sudden drop of temperature after a short period of comparative warmth did damage to young fruit trees, especially grafted mangoes and nursery plants. Setting of fruit, however, was normal in peach, plum, mango and citrus trees all over the province. Shedding of unripe mango fruits due to heavy duststorms was reported from Jullundur, Ambala, Ludhiana and Hoshiarpur districts. For utilizing this fruit large scale demonstrations for making *chutney* were arranged in some localities. One of the new schemes launched by the Department of Agriculture, Punjab, is the holding of short courses in fruit and vegetable preservation in the districts. The scheme aims at training people in preparing products like fruit squashes, jams, *chutney*, etc. in the home with a view to utilizing surplus fruit in the season. Under this scheme the newly appointed District Officer on Fruit and Vegetable Preservation conducted such courses at a number of centres all over the province.

Rapid chemical methods which can be undertaken at the spot have been evolved for testing the soil for fruit plantation. This will be helpful overcoming the failure of gardens on account of planting them in soils which have hard sub soils due to the presence of sodium clay or have high concentration of salts.

Locusts: Locust swarms entered the Punjab from N.W.F. Province at Vohoa and Bhakhar about the end of April. In a very short time the swarms spread from Attock and Mianwali to Jhelum, Gujrat, Sialkot and Gurdaspur on one side and Shahpur, Lyallpur, Sheikhupura and Montgomery on the other. Majority of the swarms were yellow in colour and sexually mature for laying eggs. Heavy egg-laying was reported from almost all these districts. Control measures were immediately organized at all these places and the pest was brought under control. Very little damage was done to the standing crops.

Lectures: Two short courses (of 10 days duration each) for home baking, which includes preparation of *dabal rotis*, cakes and biscuits have been started for ladies and gentlemen at the Punjab Agricultural College and Research Institute, Lyallpur.

Storage bins: In accordance with the India-wide plan for ideal bulk-storage, the Punjab Government at its own expense has undertaken to construct about 40 bins to store about 75,000 tons of food grains at different places in this province. This will help to save thousand maunds of food grains that are lost annually owing to inroads by pests, weevils and members of the rodent group and damage through climatic conditions. The North-Western Railway is actively engaged at some railway stations in improving such covered storage for grains as is designed to exclude rain.

Panchayat-ghars: The Punjab Government has formulated a plan for the construction of *Panchayat-ghars* for the rural areas of the province. The Government sanctioned a sum of Rs. 20,000 from the Special Development Fund for the construction of those for the year 1944-45 on condition that the village *panchayats* concerned contribute an equal amount in cash,

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kind or labour and also give land for the building site free of cost. The building plan provides a common room equipped with newspapers, books and possibly a wireless set, a fair-sized hall for common purposes, a sports ground, a garden for women, and perhaps a wrestling pit attached to it. It may contain small permanent exhibits of the different departments and serve as a centre of all official Government activities in the village and will provide a common meeting ground for the villagers and social workers.

Military dairy farm : The staff of the Military Farms Department of the Central Command have overcome the problem of processing buffalo milk for the production of tinned milk, cheese and butter, and it has been decided to establish a 24,000 acre farm near Okara, which when completed will be the largest single unit dairy farm in the world.

UNITED PROVINCES

M. R. Mahajan, M.R.C.V.S.

Cattle Development Officer, Department of Animal Husbandry, United Provinces

THE War has necessitated and forced the amalgamation of all animal husbandry activities into a single department in United Provinces to help step up production of livestock and livestock products and to organize and meet immediate demands of the defence services. The credit undoubtedly goes to His Excellency the Governor and his Government (1) in securing the services of F. Ware, Esqr., C.I.E., F.R.C.V.S., who retired from the Government of India as Animal Husbandry Commissioner, to act as the first Director of the newly reorganized Department from January 1944 and (2) in extending full help and cooperation to the Director to organize the Department not only to meet the immediate war requirements, but also to suit post-war needs of the United Provinces. The very rapid and vast expansion effected in this way is indeed a very heartening sign and the United Provinces seem to have given a lead to the rest of India in developing its Animal Husbandry on the lines chalked out in the Memorandum on the Development of Agriculture and Animal Husbandry of the Advisory Board of the Imperial Council of Agricultural Research. All the cattle breeding work done hitherto by the Agriculture Department, the United Provinces Poultry Association's farm at Lucknow, and all activities of the Veterinary Department, were placed under the new Director.

Linking of veterinary and livestock work

The long awaited link between livestock development and veterinary work, which had been accepted by the Provincial Post-War Committee at the instance of the Director of Veterinary Services in the year 1943, thus came to be established. Developmental officers for cattle, small animals (sheep, goats and pigs), poultry and fisheries and a Chief Marketing Officer were immediately appointed to assist the Director, with the dual object to ensure supplies as short term plans and to develop livestock and livestock commodities as long term post-war plans. The foremost importance was naturally given to the short term plans for developing and arranging supplies for the defence services of such livestock products as meat, milk, poultry, eggs, fish, etc. These were given effect to, keeping in full regard the conservation of livestock wealth of the province.

War efforts of the Department

Till the year 1944, the Veterinary Department as it stood at that time continued its efforts to combat contagious diseases and save livestock from their ravages and thus conserve stock for requirements of the country to enable cultivators to take effective part in the 'grow more food' campaign. The drive to produce more and efficient bullock power was continued in the 12 western districts. Efforts towards the breeding of horse, sheep and goats were also made. Attention was paid to slaughter houses, livestock markets and all livestock shows and fairs. Surplus livestock figures of the province were calculated and a quota of cattle, sheep and goats was allowed to the Army, taking care that the province was not denuded of breeding stock. The normal slaughter flow figures were maintained in respect of sheep and goats and with regard to

cattle only the useless category, calculated at 2 per cent, was allowed.

The Army were also kept informed of prevailing prices of livestock in civil markets. A short term scheme was jointly financed by the Government of the United Provinces and the Central Command for development of eggs and fowls on one hand and their supply to the Army on the other.

Livestock and livestock products supplied to the defence services

Following are the figures of supplies :

(1) Cattle 60,000, (2) sheep 1,71,600, (3) goats 6,92,300, (4) milk from Government farms 4,16,115 lb., (5) fowls, 2,72,278, (6) eggs 74,42,930 and (7) fish 1,700 md.

To help improve poultry, goats and pigs for supply of meat to the military, grants-in-aid were given to the Mission Poultry Farm, Etah and the Agricultural Institute, Naini, Allahabad. Soldiers were given practical training in dairying, goat, sheep, pig and poultry farming. Twenty candidates per month are expected from the Army to be trained and employed as stockmen in the Department.

Post-war plans

Long term plans to suit post-war development of livestock activities then followed. These include the proper arranging of cattle breeding policy both at the Government farms and in the districts, the sheep, goat and pig breeding and development of poultry. The aim kept in view is to make the province self sufficient in its requirements of livestock.

Cattle breeding policy

The Government Cattle Breeding Farms are at (1) Bharari, district Jhansi, for Hariana cattle and Murrah buffaloes, (2) Manjhra in Lakhimpur, Kheri district for Kherigarh cattle, (3) Hempur in district Naini Tal for Ponwar cattle and Tarai buffaloes. The Agriculture Institute, Allahabad, carries on breeding work with Red Sindhi. The two quarantine stations at Ata and Bainpur in Jalaun and Agra districts respectively continue to act as rearing centres for young male animals, both home bred and imported. The different districts of the province are divided into regions suiting each breed of cattle and breeding with the males of that breed only is now being advocated. Bulls of all these breeds have been arranged and they are distributed at a nominal contribution of Rs. 30. In the milk producing areas near and around the urban towns, bulls of Sahiwal and Tharparkar breeds are being issued.

The breedwise policy now being followed is as under :

Hariana : In western districts of Muzaffarnagar, Meerut, Saharanpur, Bulandshahr, Aligarh, Agra, Mainpuri, Etah, Etawah, Farrukhabad, Muttra, and a part of Dehra-Dun and also in Moradabad, Bijnor, Bareilly, Shahjahanpur, Badaun, Unao, Lucknow, Cawnpore, Hardoi, Fatehpur, Ballia and Raebareli.

Ponwar, Kherigarh and Tarai Buffaloes : The whole Tarai tract at the foot of the Himalyas comprising the districts of Dehra-Dun, Bijnor, Naini Tal, Tarai and Bhabar, part of Bareilly, Pilibhit, Lakhimpur Kheri, Gonda, Basti, Bahraich and Gorakhpur.

Red Sindhi : In the eastern districts of Mirzapur, Partabgarh, Allahabad, Benares, Azamgarh, Jaunpur, Ghazipur, Sultanpur and Fyzabad.

Kenkatha : In the districts of Jhansi, Jalaun, Hamirpur and Banda.

As this province has always lacked good breeding stock, arrangements are being made to import from the Punjab on *taqavi* or cash basis breeding cows for stock breeders. The Milk Recording Scheme partly financed by the Imperial Council of Agricultural Research which has been in operation since 1939 at Chatta, district Muttra, has proved beneficial in getting people interested in improving cattle. To intensify and multiply this work in one of the best breeding tracts, e.g. Meerut district, it is proposed to use 77 selected villages as 'key' village centres for the production of stud males. The work on artificial insemination as demonstrated by the Imperial Veterinary Research Institute, Izatnagar, and Agricultural Institute, Allahabad, is contemplated to be taken up by the Animal Genetics Section at the Livestock Research Station, and this will be applied both at the farms and in selected breeding tracts as soon as possible.

Provincial livestock research station

The Provincial Livestock Research Station is being set up on the old Madhurikund Cattle Farm (Muttra) site which is being restored to the United Provinces Government by the Government of India. The Research Station will have three sections, viz. Animal Nutrition, Animal Genetics and Animal Disease Investigation. Suitable officers are being recruited and awaiting to proceed abroad for higher studies in Genetics and Nutrition.

Cattle shows and markets

Cattle shows have been reorganized under the new Department which also receives prize money and recognition from the All India Cattle Show Society. These are held at Nauchandi (Meerut) for Hariana cattle and Murrah buffaloes, Puranpur for Ponwar cattle, Lakhimpur for Kherigarh cattle, Ajaigarh for Kenkatha cattle and Chakarnagar for goats. A large number of one-day horse and cattle shows are also held in most of the western districts of Meerut and Bareilly circles. All the annual livestock fairs and weekly cattle and other livestock markets are being attended to by the staff regularly. Arrangements are afoot to run a weekly market news service for the most important livestock commodities of the province by gathering of such information from all important 'key' markets.

Dairy development

This scheme is being launched with a view to help increase milk and milk products and to demonstrate improved methods to those interested, and also to help in the drive to produce males required for breeding purposes. For this the Post-War Reconstruction Committee of the province has accepted the proposals of the Director to open a dairy demonstration farm in each of the 48 districts of the province and in the emergent two years' scheme six such farms are proposed to be established and these in the first year will be located in the districts of Farrukhabad, Lucknow, Muzaffarnagar or Agra where sites have been secured. A Dairy Development Officer is being recruited for the purpose.

Ghee *development*

In the backward districts of the province, efforts are being made to increase production of this commodity in areas which have little or no market for milk. To check adulteration and ensure better marketing an 'Agmark' *ghee* grading centre has been established at Shikohabad and two additional centres are now being opened.

Feeds and fodder arrangements

One very important step taken by the Department has been in the matter of feeding of stock, as it is well known that by better feeding production can be enhanced by as much as 30 per cent. Experimental supply of oil-cake at controlled rates through the veterinary hospitals in Muzaffarnagar district has encouraged the Government to go forward with the expansion of this scheme in all the hospitals in the province. It is intended to include other concentrates as well in the scheme later on. So far as the supply of fodder seeds and cuttings is concerned, a sum of Rs. 50,000 was placed at the disposal of Agriculture Department for supply of these at a concession rate to cultivators and stock breeders.

Biological products section

The Veterinary Section and the Disease Investigation Scheme are intensifying their efforts to control the spread of epidemics and prevent losses in improved livestock. A separate Biological Products Section is being developed and an officer incharge has been appointed to supervise manufacture. At present vaccines against rinderpest and haemorrhagic septicaemia are being produced. Ranikhet vaccine is also proposed to be manufactured locally shortly. Following vaccines were supplied during 1944-45:

Rinderpest tissue vaccine:

G. T. vaccine	Macerated vaccine	Dry vaccine	Total
1,73,600	54,100	3,600	2,31,300

During the first quarter of 1945 the quantity issued was:

G. T. vaccine	Macerated vaccine	Dry vaccine	Total
2,36,600	Nil	7,500	2,44,100

Haemorrhagic septicaemia vaccine: The quantity supplied was 3,99,610 doses and during the first quarter of 1945, 2,38,550 doses. Besides these, rinderpest serum, fowl-pox vaccine and blackquarter serum were also received from Mukteswar and issued to districts.

JAMMU AND KASHMIR

Jia Lal Raina, M.Sc. (Hons.)

Department of Agriculture, His Highness' Government, Jammu and Kashmir, Srinagar

War has brought a favourable opportunity for the cultivation of fruit in Kashmir, especially the apple, for which the State is well-known. It has stimulated the fruit culture to a considerable extent. The present favourable return from fruit orchards

has made the owner very careful in keeping his fruit trees in perfect health. This has resulted in great demand for technical assistance and fruit trees of definite commercial varieties from the Departmental nurseries. Formerly the Department had to persuade the people to effect improvements, but now reverse is the position.

Large part of the Kashmir apples have been purchased by the Indian army for the fighting forces direct, which has resulted in distribution of proper percentage of the selling price to the orchardists. The fruit that was directly purchased by the Army was graded before despatch by the Department of Agriculture and it reached its destination, i.e. the Burma front in a fairly sound condition. These measures of packing and despatch of fruits have helped in effecting the filtration of the practices of grading and scientific packing down to the individual orchardists, who previously were quite ignorant about these and had simply to rely on what they heard from Rawalpindi, the main distributing centre.

English varieties of vegetables

The 'grow more food' drive has resulted in establishing a seed scheme, run under the auspices of the Government of India in the Department of Agriculture. The scheme was in the first instance sanctioned for one year and has been extended for a further period of one year at a total cost of Rs. 37,952. Out of this amount two-thirds had to be contributed by the Government of India and the remaining one-third by His Highness' Government, Jammu and Kashmir.

During the year 500 seed farms with an area of 1,000 acres were working under the scheme. The total production has been very considerable for all kinds of vegetables, but unfortunately the estimated demand did not come with the result that large quantities of seeds, particularly those of cabbage, carrot, knol khol and turnips remained in stock with the growers. At present the growers hold stocks worth several lakhs and only seeds worth about Rs. 2,87,000 have been exported out of the State departmentally. The Government levied a nominal tax of one anna per seer and the returns amounted to Rs. 8,105.

At present the rules have been relaxed and the growers are permitted to have direct dealings with the consumers. The tax has been raised to 12 per cent on the fixed sale prices. This system to a great extent has handicapped and complicated the business and the few main growers have started profiteering at the expense of small growers who cannot reach the Indian market.

Entomological work

The entomological section was busy with spraying of the trees against San José Scale and Woolly Aphis insects. A total of 2,46,346 Government and 3,28,700 private trees were sprayed in the dormant season. Above 25,000 gallons of diesel oil and 8,600 lb. of fish oil and local resin potash soap were used.

Great difficulty was felt by the section in rationing the spray oils in the Kashmir province. Exact quantities of oil required by the orchardists were not available and whatsoever quantity was available could not be transported in time and hence there was discontentment. However efforts were made to pacify the people and a lot of spraying was conducted in the limited time available. While the resistant varieties of fruit trees were left unsprayed, preference was given only to those which were infected or were susceptible to infection.

In Ranbirsinghpora (Jammu) local grasshopper attack was reported to be threatening. The State Entomologist, who was at that time in Jammu province, was instructed to switch his activities on to its control. He took the work immediately in hand and demonstrated the control measures in almost all the parts of the *tehsil*. Hopper catchers were made use of by him with success, and many maunds of hoppers were collected and destroyed. Considering the efficiency of these hopper catchers, the sugar mill authorities distributed a lot of these to their farmers for protecting the sugarcane from the ravages of the insect. The Department of Agriculture too took an active part in lending out catchers free of rent.

Seed distribution

Improved and acclimatized agricultural and vegetable seeds are raised in the Departmental farms both in Kashmir and Jammu and then supplied to zemindars at *tehsil* headquarters at local prices. In certain cases seeds are supplied to zemindars free of cost on the condition that at the harvesting season they shall return double the quantity of the seed supplied, half in return for the seed supplied and the other half on cash payment at the prevailing market rate. As such about 1,050 maunds of paddy;

116 maunds of oil seeds and 9 maunds of fodder seeds were distributed in both the provinces.

Nursery work and distribution of plants

Deciduous fruit plants in Kashmir, Batote and Budrawah and sub-tropical fruit plants in Jammu were raised in Government nurseries and distributed to zemindars at a very nominal price of one anna each. In all about two lakhs of such nursery plants were distributed. The bulk of these plants consisted of deciduous types. The demand for the deciduous plants is increasing everyday and the Department of Agriculture can hardly meet the demand. The supply had to be restricted to a very low percentage of the demand. To cope with the work the Department is increasing the area. Over and above the Department, some of the practical horticulturists have started their private nurseries and will be in a position to meet the demand to a great extent in the near future.

Cattle shows

Cattle shows were held at Ranbirsinghpora, Udhampore and Mirpur *tehsils* in the Jammu province, by the Veterinary Department. In all these shows the progeny of the Dhani breed predominated. The best animals were judged by the judges and were given prizes. Agricultural shows were held in various parts of the Jammu province and prizes were given for the best exhibits.

GOWSHALAS AND PANJRAPOLES

H. S. Bawa, M.R.C.V.S.
Director of Veterinary Services, Sind

THERE are about 3,000 *gowshalas* and *panjrapoles* in India and nearly five crores of rupees are spent for their maintenance every year. Majority of these institutes are not run on scientific lines but are generally run from the sentiment arising out of the desire to protect animals from destruction and pain. These institutes, if they combine the two objectives, viz. to protect the animals from destruction and pain and to effect an increase in the milk supply by careful management, proper and scientific feeding and breeding with a view to meet the ever increasing demand of milk, will serve both the humanity and the dumb creatures better as well as benefit the institutes themselves by larger income due to sale of milk. The consumption of milk per capita in India is extremely small, i.e. 5 to 6 ounces, whereas the minimum quantity needed to maintain the human body in health is 16 ounces.

Panjrapoles *in Sind*

There are about 20 *panjrapoles* in Sind and four out of these, viz. those at Karachi, Shikarpur, Sukkur and Hyderabad are very big institutes. The Karachi *panjrapole* has seven branches, two in Karachi City and five in the outskirts 15 to 20 miles away from Karachi. The Karachi *panjrapole* maintains 698 dry cows, 94 cows in milk, 8 good stud bulls, 280 young female stock under three years old and 27 young male stock. They have 2,273 acres of land for grazing. The grazing is ample just after the rains, viz. during the months of August, September and October, when there are copious rains and during this time the *panjrapole* authorities cut the grass and stock it in big stacks to be used during periods of draught. During winter months there is scarcity of green fodder and cattle have been seen to suffer from Vitamin-A deficiency. The five outstations are used for keeping dry cows, young stock and infirm animals. The Karachi *Panjrapole* Association keeps a qualified Dairy Manager to look after the animals. One officer is very inadequate to look after 1,429 animals.

The Sukkur *panjrapole* maintains 300 dry cows, 100 cows in milk, 203 young stock and 5 bulls and have 95 acres of land for cultivation of fodder and grazing. The Hyderabad *gowshala* has 262 dry cows, 130 cows in milk, 324 young stock and 8 bulls and 120 acres of land for cultivation and grazing.

Government help

In pursuance of the recommendations adopted in 1942 by the Animal Husbandry Wing of the Board of Agriculture and Animal Husbandry in India, a meeting of a few representatives of

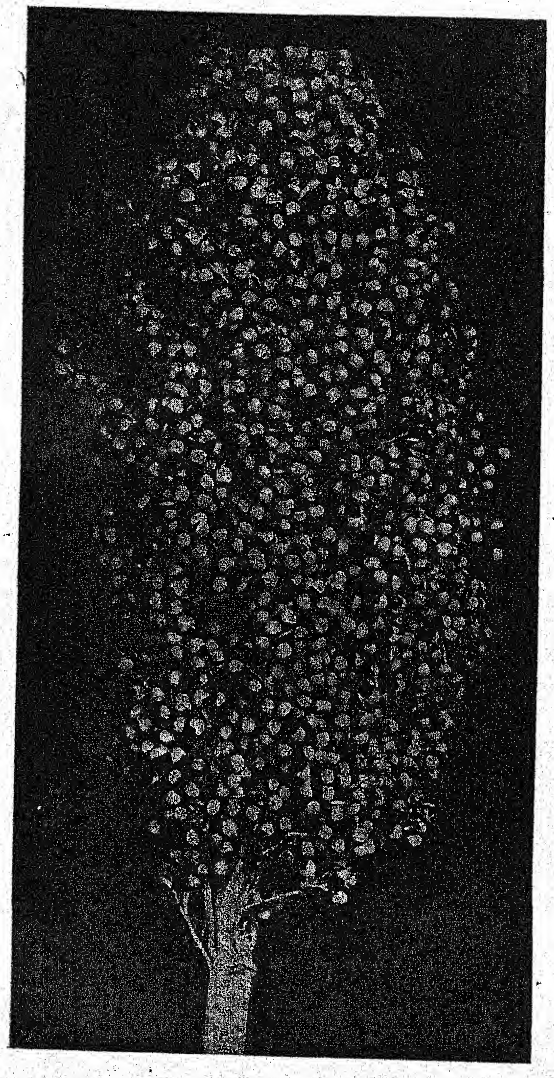

FIG. 1. Sorghum A. S. 29. (*Cholam*)

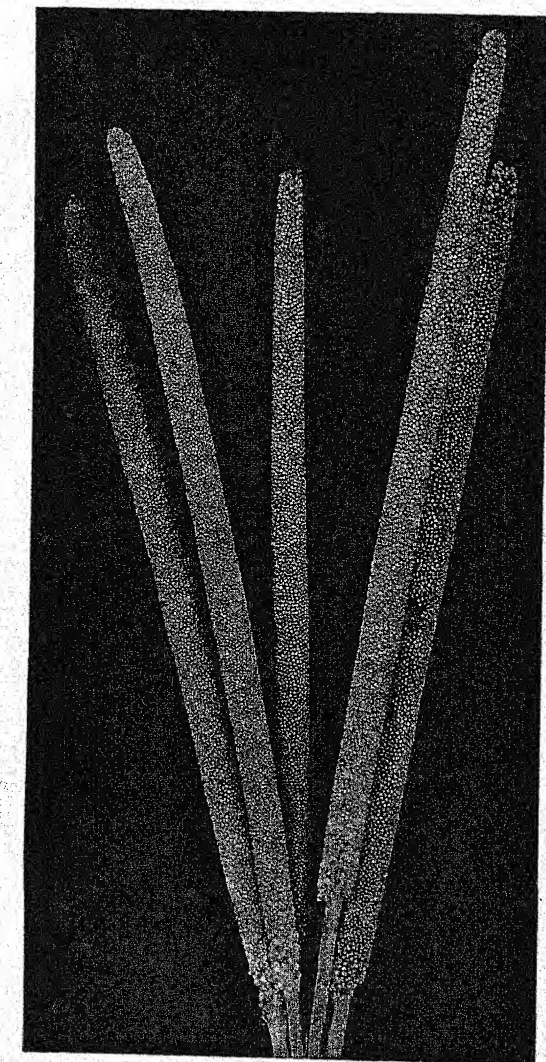

FIG. 2. Penisetum P. T. 700. (*Ganti*)

PLATE 13

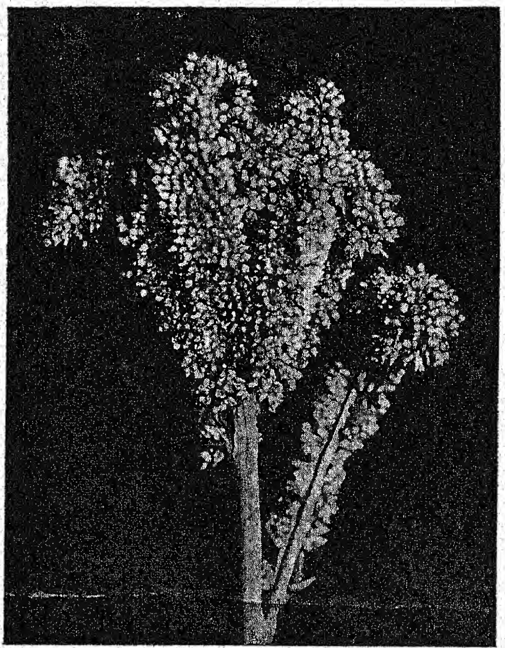

FIG. 2. Elusine Coracana. (*Ragi*)

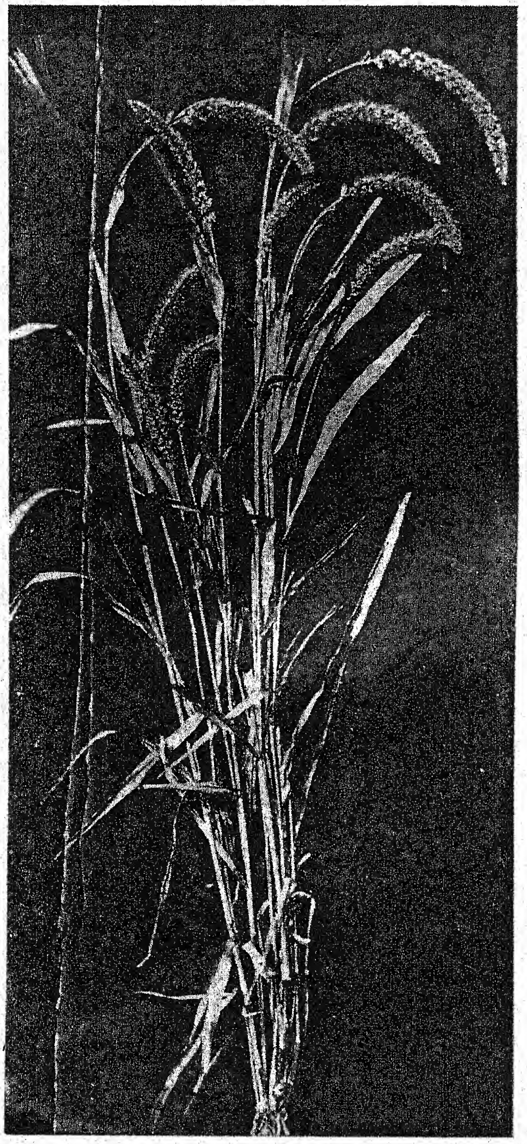

FIG. 1. Italian millet. (*Korra*)

gowshalas and *panjrapoles* from major provinces was held in New Delhi on 25 March 1944, under the auspices of the Imperial Council of Agricultural Research. It discussed the directions in which the work of *gowshalas* and *panjrapoles* might be developed for the furtherance of cattle improvement.

The meeting considered that the first step was to make a rapid survey of these institutions for the purpose of obtaining a general picture of the methods of their working and facilities and resources available to them at the present. It would then be possible to indicate what steps should be taken for effecting cattle improvement and production. A small sub-committee consisting of the Vice-Chairman, Imperial Council of Agricultural Research, Sir Datar Singh and Mr. Mankar was appointed to draft a questionnaire for the purpose.

A very exhaustive and comprehensive questionnaire was drawn up by the sub-committee and circulated to Veterinary Departments of different provinces for collecting information. Later on Sir Datar Singh was appointed Honorary Cattle Utilization Adviser to the Government of India. He has been touring different provinces and holding discussions with Directors of Veterinary Services and of Agriculture and with presidents and members of *gowshalas* and *panjrapoles*. Such personal contacts with *gowshala* and *panjrapole* authorities have, to a greater extent, narrowed down the gulf betweeen them and the Government and now the authorities are eager to accept the help of the Government. *Gowshalas* are to be offered Government help if they add the production of good dairy bulls, an increase in milk supply and the maintenance of dry city cows between lactations to their function of caring for old and infirm animals.

Needs of gowshalas

Gowshala organizations stressed that for their betterment the following two ways of assistance by the Government were essential:

1. Provision of expert and technical personnel.
2. Provision of land for grazing.

Scheme for Sind panjrapoles

Sir Datar Singh, Cattle Utilization Adviser and Mr. Zal R. Kothavalla, Diary Development Adviser respectively to the Government of India, visited the Karachi *panjrapoles* and its outstations during the month of May 1945 and discussed with the Directors of Veterinary Services and Agriculture and with the president and members of *panjrapole* Associations, ways and means of improving the present system of running the *panjrapoles*. After discussion the following scheme was proposed by Sir Datar Singh, which is before the Government for consideration.

1. There should be a Class II officer, who should be well versed in the management and breeding of cattle and should be able to impress upon the *gowshala* workers and organizers the necessity of adopting improved methods to increase the milk production, of effecting improvement of cattle, of the castrating of useless male stock and of segregating cattle into different groups, viz. milch cattle, dry cattle, young stock and infirm stock. This officer shall have to do about 20 days touring in a month and tender advice to different *gowshalas* in Sind and help them in their difficulties by putting them into touch with different Departments like the Veterinary, Forest and Agriculture. He will act as the Secretary of Sind Provincial *Gowshala* Organization when it comes into existence.

2. At present there is a great dearth of trained and experienced people who can work in *gowshalas* and improve their condition. We shall therefore have to start classes of say 25 to 30 selected people sent by different *gowshalas* for a course of about six months, in an Agricultural College, to give them training in the management of cattle, including dairying and general knowledge of agriculture, so that these people, properly equipped with scientific knowledge, can go back to their respective *gowshalas* and work for their improvement.

The expenditure involved in the scheme can be shared between the Sind Government and the Government of India on a 50 : 50 basis, and the cost of boarding of the trainees can be borne by the *gowshalas*. The detailed syllabus for the course and the question of minimum qualifications for admission can be mutually decided.

3. A scheme should be set up for the supply of good bulls to the *gowshalas* in the whole province, which would replace the useless ones, their number being double that required in order to allow for losses due to mortality and also for providing free service to the neighbouring villages and towns.

This will result in immediate increase of milk and improvement of cattle and can very well fit in with the 'grow more food' campaign.

After three years the *gowshalas* will be able to give about 20 per cent of their best male stock for free distribution in the neighbouring villages and will also replace their own stock and there will be no necessity for the Government to provide them with bulls any more. This will be the cheapest and the quickest way of supplying free bulls which is very essential.

The cost of the scheme will be about Rs. 43,000 for the first year shared on a 50 : 50 basis between the Government of India and the Sind Government.

ONE-DAY CATTLE SHOWS IN KISTNA DISTRICT DURING 1944-45

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ONE-day cattle shows organized by the Civil Veterinary Department have become very popular in the province. Influential and interested cattle breeders and owners have become alive to livestock improvement in their areas with the result that in addition to the cattle shows held under the auspices of the provincial Government, private cattle shows are organized and run very successfully.

During the year 1944-45 in the Kistna district nine such shows were held, one in each taluk of the district ; of these four were run by the Veterinary Department and the remaining five were privately organized. The four Government shows were held in Nuzvid, Gundlavalleru, Bhatlapenumarru and Katuru. Three taluk shows were held at Kaikalur, Tiruvur and Bandar. One district show was organized at Bezwada. The zemindar of Muktyala organized a cattle show at Kanchala entirely with his own private funds. A grant of Rs. 150 was made by the Government for each show organized by the Department. The Collector of Kistna had sanctioned a sum of Rs. 100 for each of the taluk shows and Rs. 200 for the district show from his discretionary grant. Various ryots' associations in the district contributed liberally to all the shows in addition to the Government and Collector's grants and a very large number of prizes were awarded to the exhibits at each show. The annual animal show of the S.P.C.A., Bezwada, was also combined with the district cattle show and as many as 49 prizes were awarded to the exhibits. The details of the shows held in the district with all relevant particulars of each show is appended herewith in a tabular statement.

Name of the show	Taluk	Date	Kind of animals for which the show was organized	No. of animals exhibited	No. of prizes awarded	Value of prizes awarded	Govt. contribution, if any	Remarks
Kanchala	Nandigam	15-1-45 16-1-45	Cattle and buffaloes	172	20	Rs. 550-0-0	*nil*	Zemindars private funds
Nuzvid	Nuzvid	16-2-45	do.	176	47	Rs. 842-10-6	Rs. 150	
Katur	Gannavaram	21-2-45	do.	126	36	Rs. 484-14-6	Rs. 150	
Gundlavalleru	Gudivada	27-2-45	Buffaloes only	87	15	Rs. 265-0-0	Rs. 150	
Bhatlapenumarru	Avanigadda	10-3-45	Cattle and buffaloes	125	24	Rs. 253-4-0	Rs. 150	
Tiruvur	Tiruvur	18-3-45	do.	183	37	Rs. 736-14-0	Rs. 100	
Masulipatam	Masulipatam	20-3-45	do.	46	12	Rs. 195-0-0	Rs. 100	
Kaikalur	Kaikalur	22-3-45	do.	85	36	Rs. 415-0-0	Rs. 100	
Bezwada District Show combined with S P.C.A.	Bezwada	26-3-45 27-3-45	Buffaloes and ponies	146	49	Rs. 650-0-0	Rs. 200	

In other lands

MECHANIZED RICE FARMING IN AUSTRALIA

INTRODUCTION of large-scale mechanized methods of rice farming has been instrumental in enabling Australia to make an important contribution to relief of the rice shortage caused by Japanese agression. Australia's foremost rice-growing area, established as a result of war needs, is the Government farm of 4,803 acres at Wakool, on the River Murray, source of supply for the irrigation of this and other farming schemes. Favourable climatic conditions, methods of mechanization employed, and the size of this project have resulted in low production costs. However, although production has been increased, Australia still produces only a very small portion of the world output of rice. In 1939-40 her crop was considerably less than one thousandth of that of India. During the war it has been increased by 75 per cent. Peak output is 75,065 tons in 1943-44. It is in the methods employed and the size of the Government farm at Wakool, that interest chiefly centres. Rice is also grown on considerably smaller holdings in Australia. In the Murrumbidgee Irrigation Area of New South Wales, it is grown on irrigated farms of about 550 acres, but this area is not completely devoted to rice growing. Fruit and other crops are also produced. The Wakool project is operated on Tulla station by the New South Wales Water Conservation and Irrigation Commission for the Australian Federal Government. It is one rice farm with 4,803 acres under crop and is believed to be the largest single rice farm in the world. Labour at Wakool has consisted of 170 Italian prisoners of war. All rice in Australia is grown under irrigation, and by power farming. Annual rainfall in the rice-growing areas is about 14 to 16 inches.

Power farming methods

The first step in establishing an Australian rice farm is to make a close contour survey of the land. Substantial check banks are then built to hold irrigation water to a depth of from six to ten inches. The land is ploughed and cultivated by multiple disc ploughs and harrows drawn by tractors, as in Australian wheat power-farming.

Rice is sown in the dry by a combination cultivator-seed drill of the type used for planting other cereals in Australia. Sulphate of ammonia is used as a fertilizer if required.

Sowing generally takes place in October.

After sowing, the land is flooded from the irrigation canals, and immediately drained. After germination and a growth of, say, four inches, the land is flooded again, usually in November, and the water is held at depths of six inches to ten inches until the rice matures. It requires an average of from six to seven acre feet of water per acre to produce a rice crop in Australia. (An acre foot is the amount of water required to submerge one acre to a depth of one foot). After the rice matures the water is drained off, and the rice is harvested in April, May and June.

Mechanized harvesting

Harvesting is by tractor-drawn, power-driven combination reaper-thresher, which reaps, threshes and bags in one operation. Each of these Australian-developed and Australian-built machines is capable of harvesting up to 900 bushels of paddy rice (the rice with the husk still on) a day. It is a development of the Australian machine designed for harvesting wheat and other grains, but has special attachments to enable the heavier rice crop to be gathered.

Each farm has its own sowing and harvesting plant. These farms are of a mixed nature, usually combining fruit growing with rice production and a little dairying, according to soil formation and type. The farms on the Murrumbidgee Irrigation Area are of 550 acres, and before the war the area of rice sown on each farm was limited by the grower-controlled Rice Marketing Board of New South Wales to a maximum of 80 acres. Yields vary considerably by the season, but average slightly under two long tons (4,480 lb.) an acre. The rice is a standard Japanese variety, and was originally brought from California.

Distribution of the rice

Distribution of Australian rice in 1943-44 was:

Eighty per cent of Allied, British, Asiatic and Pacific Isles troops in the Pacific;

About 15 per cent to inhabitants of Pacific Islands whose staple food is rice, and whose normal supplies have been cut off by the Japanese;

About five per cent to Chinese and other Asiatic residents of Australia, visiting Asiatic seamen, and Australian hospitals.

Australian rice has had quite an important place in the food strategy of the United Nations east of Suez. When an acute rice shortage developed in Ceylon, Australian supplies helped to overcome the emergency, caused by the Japanese overrunning normal areas of supply. Before the war Australians consumed about five to six pounds of rice a year. Inhabitants of Pacific islands consumed about seven to eight pounds a week. When their source of supply was cut off by Japanese conquests, rice disappeared from Australian tables and was diverted to areas where it was a staple food. The Australian rice industry first met all Australia's rice requirements in 1929. There has been a surplus for export each year since 1930. The amount available for export has been extremely small in comparison with world production. The largest amount sold to millers by the Rice Marketing Board, which controls all the output, was 25,888 tons of paddy rice in 1939. Quantities exported during the war are not available for publication.

In 1944-45 a restriction of water, made necessary by drought, and seasonal conditions, more than halved production compared with the previous year. Cold weather and dust-storms—the latter are stated to have interfered with the pollination of some crops—were the main adverse seasonal conditions. Acreage planted for the 1944-45 crop was 19,793 acres on the Murrumbidgee area and 4,803 acres at Wakool. Total plantings were only 61 per cent of the target of 40,000 acres set.

Expansion of rice cultivation

Right from the inception of the Murrumbidgee Irrigation Areas, consideration was given to the possibilities of rice as one of the staple crops. For a number of years the N.S.W. Department of Agriculture at the Yanco Experimental Farm (which was established very early in the settlement's history, 1908, before the first sod on the settlement itself was turned), planted 'pocket handkerchief' plots with rice, but results were uniformly adverse. In 1921, an analysis by the Water Conservation and Irrigation Commission showed that the various failures at the Yanco Experimental Farm could not be taken as anything like conclusive evidence that rice was unsuited to the district. Mr. J. Brady, who was the manager of the canning factory at Leeton (and is now chairman of the Rice Marketing Board) investigated the question of the introduction of suitable varieties of rice when he was in America on business in 1922. Mr. Brady visited some of the rice-growing centres in California, and was greatly struck by the similarity of some of the soils (shallow, clayey loam with a heavy retentive clay sub-soil) to soils, which were proving unsuitable for any other crop on the Murrumbidgee Irrigation Area. After a study of the climatic conditions in those Californian centres, he there selected three varieties of rice as likely to give good results. On his return experimental plantings were made near Leeton. From these trials satisfactory yields of from 72 to 77 bushels an acre were obtained.

Trials were continued, farmers on the irrigation areas became interested, and in 1924, for the first time in Australia, rice was grown commercially. In that year 157 acres were cropped, and an average yield of 65 bushels was obtained. Succeeding years saw the acreage under rice considerably increased, and the number of rice farmers grew correspondingly. The industry expanded at such a rate that by 1927-28 an aggregate crop of 16,483 tons of paddy rice was harvested. Cooperation to preserve their interests has been recognized as necessary by the growers, and in the latter part of 1928 it was decided to take advantage of the New South Wales Marketing of Primary Products Act (1927) and to vest the entire control of the new industry in the hands of growers' nominees. The Rice Marketing Board of New South Wales was brought into being in November 1928. Storage sheds were immediately erected by the board at various centres on the Murrumbidgee, with a total storage capacity of 20,000 tons of rice. No milling or processing of grain is carried out under the Board's control, the paddy rice being disposed of through millers operating chiefly plants in the capital cities on the seaboard—mainly Sydney and Melbourne. A rice mill is also operating at Cootamundra, New South Wales, and a large mill has been in operation for two

years at Griffith in the rice-producing district. A small mill has been in operation for some years at Murramu, about 15 miles from Leeton, the headquarters of the Rice Marketing board.

Wartime production

Production during the war years has been as under:

Season	Acreage	Tons
1940–41	24,625	41,547
1941–42	23,725	41,147
1942–43	34,345	57,153
1943–44	40,495	75,065 (record)

Because of increased production in 1943-44, the Commonwealth Government erected two large storage sheds on the Murrumbidgee Area, one at Whitton and one at Griffith. This gave a total storage capacity on the area of 29,000 tons. The balance of 46,000 tons was sent from the fields to millers.

During the war the Marketing Division of the Federal Department of Commerce has taken control of the allocation of all supplies of milled rice. The requirements of the Services, and all supplies for the Pacific islands and other parts, are allocated by the department.

Production figures

Before Australia began to grow rice, amounts imported into Australia were:

	Un-cleaned Tons	Cleaned Tons	Total Tons	Re-exported Tons	Excess imports over exports Tons
1922–23	9,845	9,713	19,558	5,150	14,408
1923–24	15,080	16,606	31,686	5,563	26,123

For the five-year period ended 1926-27 the approximate average annual consumption in Australia was 14,949 tons of cleaned rice, which is equivalent to 24,149 tons of paddy rice.

The value of the 1928-29 crop to growers was £239,585 and the value of the 1943-44 crop was about £863,280.

Production figures from the foundation of the industry to the outbreak of war (war production is given in an earlier table) were:

Season	Acreage	Tons	Tons to acre
1924–25	157	222	1·41
1925–26	1,978	1,500	·75
1926–27	4,772	4,887	1·02
1927–28	12,080	16,483	1·36
1928–29	14,058	23,228	1·65
1929–30	19,997	32,862	1·64
1930–31	20,256	26,084	1·28
1931–32	18,243	23,882	1·30
1932–33	22,787	35,347	1·55
1933–34	20,379	39,939	1·95
1934–35	21,944	34,914	1·59
1935–36	21,757	39,180	1·80
1936–37	23,485	42,020	1·78
1937–38	23,814	42,113	1·77
1938–39	23,532	51,517	2·19
1939–40	24,263	34,251	1·41

—*Australian Agricultural News Letter*, July, 1945

KUDZU—ANOTHER AGRICULTURAL MIRACLE

RUSSELL LORD

IT was a hill farm in Alabama. If ever a farm were visibly dying, this one was. All of the topsoil had gone to the creeks and the sea. The field on which we stood was so gullied you had to keep jumping to get across it. The land was worn and bare, the sagging house was empty. But if you looked closely, here and there in the gullies you could see ropelike vines crawling, hugging the ground, beginning to net it down. It was the first planting of kudzu, the new cover crop that I had ever seen.

'A man hanged himself in that house, and the bank took over the place. Now this field will heal soon and make fine pasture. It will be green next spring', my companion, R. Y. Bailey, said. 'Kudzu' Bailey, they called him. It was in December of 1936. Only a few shared Bailey's faith in this Japanese vine as a field crop, and not a few were afraid that it would be a more menacing pest than honeysuckle, spreading to take over the entire countryside.

Bailey and a few other believers replied that when a plant grows like honeysuckle yet feeds like clover or alfalfa, with approximately the same protein and carotene content, there was no point in being cautious. They showed that kudzu not only wove a mat of protective cover but worked as a legume to draw free nitrogen from the air and store it for plant use in the soil. So kudzu plantings kept marching on to heal slashed land and great gullies.

Last June I spent a week-end at the Georgia farm of Channing Cope, an influential kudzu grower. Cope says kudzu was brought in from Japan as an ornamental vine. He planted his first field of it in 1927, when he acquired 700 acres of run-down land near Covington, 30 miles from Atlanta. Yellow River Farm, it was called, for the river that drained it was yellow with topsoil.

Today the whole place stands out as a green oasis amid graybrown cottoned-down country. 'Cotton isn't king here any more', Channing Cope says happily, 'Kudzu is king'. Livestock multiply in the meadows, the soil is held secure, the place is making money.

We stood that blazing hot Sunday at the edge of a marvellous vine land. The kudzu had made a riotous growth, hip deep, all over the hill. The ground was as damp and cool as that of a deeply shaded forest floor. 'They took some temperatures over at the Experiment Station on a day like this' said Channing. 'Bare ground was 140 degrees Fahrenheit at the surface. Under kudzu the ground temperature was only 89 degrees. That's something to consider. Many soil men here in the South wonder if the fierce heat on the tilled fields doesn't hurt soil and hinder humidification'.

'And just look at this kudzu duff'. He scooped up a handful. Those big, delicate leaves, shed from last years crop, make a flaky mould that covers the ground completely and enters as organic matter to lighter topsoil fast. The cover on that field felt like a deep mattress under your feet.

Kudzu stands drought well. Some roots go 12 ft. deep. Each crown puts out from one to four vines, and new crowns form in the joints and nodes. Five hundred crowns will plant an acre, about one crown to every 85 square foot. On rich soil the vines may grow 12 in. a day at the peak of the growing season, and 100 ft. of growth in a year is not unknown. Even the first year's yield may be considerable, but it usually takes three years for the crop to take full possession of the acreage. Kudzu may be pastured or cut with a mower and taken as hay. 'This 35 acres will make at least 3½ tons of hay to the acre this year, drought or not', Cope told me.

I do not think that I ever saw a more erosible soil anywhere than on this farm. It washes like sugar. Even a cart track through new grassland will start a gully. But once kudzu has taken hold thoroughly, the trouble ends. That solid mat holds the soil.

Hugh H. Bennett, Chief of the U.S. Soil Conservation Service, said recently, 'What, short of a miracle, can you call this plant?

Kudzu has forced our service to revise our appraisal of a lot of severely eroded land as having been ruined for further agricultural use. And it is not only a crop for gouged-out land; it is a splendid crop for good land, too. It will cover a corn-field one year; the next spring or early summer it can be ploughed and the land planted to corn; then after the last cultivation of the corn it will again spread over the field, stop the erosion, store more nitrogen, and at the first hard frost lay down a carpet of rich leaf litter at least the equal of forest litter. All this in one year'.

Northern farmers are beginning to envy the South in having this marvel. Geneticists are now working to develop hardier strains that will push the kudzu belt northward.

In a part of the country farmed almost to death under the old crop-land-chop system, kudzu is lively, hopeful, exciting. 'A strange ecstasy', Cope says, 'lifts southern growers' hearts and exalts their language when they get together to praise kudzu'. At a meeting of the Kudzu Club of America in Atlanta last spring one man told how he raised eggs for three cents a dozen on kudzu hen pasture; others testified that corn yields had risen from fourfold to sevenfold on fields that had been in kudzu. One man told of his progress in dehydrating kudzu for stock feed and human use.

The Kudzu Club has set as its goal a million acres of kudzu in Georgia by 1950 and eight million acres for the South as a whole. 'That wouldn't be a bit too much to support the livestock economy we need, and help make our agriculture permanent', Channing Cope says.—*Country Book Magazine*, New York, Autumn, 1944.

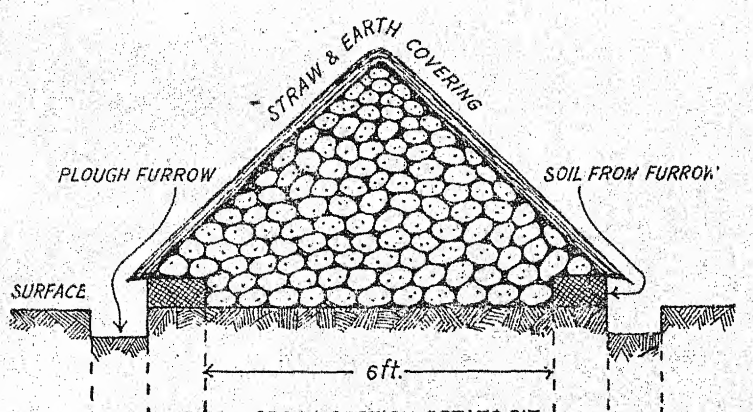
PITTING POTATOES

G. H. Mattingley

The best method of storing potatoes intended for table use is by means of holding them in 'pits'. By this means, loss in weight and wastage are reduced and the tubers may be retained for extended periods with the least possible deterioration in quality and condition.

In choosing a site for the pit, see that it is well drained. This is essential for the proper keeping of the potatoes. Consideration should be given to the site being conveniently placed to the paddock in which the potatoes were grown and its suitability as a location from which the potatoes will be loaded for market. For the comfort of those who will be bagging and grading the tubers, the pit should be placed in a sheltered position, if this can be arranged. This work usually has to be done in the open, sometimes in inclement weather.

A convenient width for the potato pit is from six to eight feet, and an effective way of farming this area is to plough inwards two parellel furrows so that the required width lies between them. The sods from the furrows act as checks which determine the size of the pile, while the furrows facilitate drainage. Logs of 6 × 1 hardwood planks set on edge are also suitable for forming the boundaries of the pit. The length of the pit will depend on the tonnage of potatoes to be stored; if the site chosen is suitable, the pit can be extended as desired.



CROSS SECTION POTATO PIT

The potatoes should be built up as steeply as convenient—an angle of about 45° is practicable.

As the pit progresses, the sides and end of the heap should be covered with a layer of straw about four inches deep. A capping of straw placed across the ridge so that the ends overlap the straw at the sides will shed off any rain. Rye or wheat straw or reeds where available are preferable to oaten or barley straw, as they are not likely to consolidate and restrict the ventilation essential for safe storage.

The thatch may be secured against wind by a light covering of soil, or by rails or scantlings. If soil is used it should not be placed higher on the sides of the pit than nine inches from the top of the ridge on either side.

For small lots of one ton or less, the pit may be made with a circular base, and built up as high in the centre as the base will permit.

Only sound potatoes should be pitted, and it is important that growers contemplating this method of storage should know the chief causes of wastage, so that they may be avoided. Sweating and heating will occur if potatoes are stored in heaps so large that air cannot circulate between the tubers. The risk of loss from this cause is greatest with immature tubers, therefore, potatoes intended for pitting should be fully mature before lifting.

Rotting will probably occur in potatoes that have been pitted in a wet condition or which become wet during storage owing to inadequate cover. As potatoes are easily damaged by even a light frost, every precaution should be taken to protect them after harvest and during storage. Frosted potatoes are unfit for human consumption.

It is highly desirable that potatoes be carefully picked over and all diseased tubers removed before they are placed in the pit. If diseased tubers are mixed with sound ones, the higher humidity within the pile favours the development and spread of the disease organisms to the surrounding healthy tubers.—*The Journal of the Department of Agriculture*, Victoria, July, 1945.

DEHYDRATION OF VEGETABLES

In response to an invitation by the Central Food Department, representatives of dehydrated vegetable factories met in New Delhi recently to investigate the possibilities of vegetable dehydration in the civilian economy of the country, now that military demands had ceased.

Explaining the official viewpoint, Mr. Lobo Probhu, Deputy Secretary, stated that the Food Department was keen to afford technical advice and assistance, in obtaining controlled materials and manufacturing plants to the factories to maintain production, but experts were of the opinion that at present dehydration would be a speculative production which would have to proceed cautiously and in stages. The problem of utilizing these factories to meet civilian requirements was not peculiar to India, but was being faced in the U.K. and the U.S.A. the most advanced countries in vegetable dehydration. While dehydration can enable conservation of food liable to waste during periods of seasonal gluts, it is pointed out that it has to face competition of processes like refrigeration and canning. The scope is, therefore, limited to classes which cannot afford or obtain refrigerated and canned products.

Representatives of the industry decided to explore the possibilities of the market further in the light of the information given at the meeting, and to submit concrete proposals for assistance from the Government.

In 1945, 18 factories manufactured about 3,350 tons of dehydrated vegetables for the Army.—*Indian Information*, January 15, 1946.

New Books and Reviews

MALNUTRITION

By Norah Curtis and Cyril Gilbey (Oxford University Press, Nicol Road, Bombay, pp. 87, 2s. net.)

MALNUTRITION when it is present in a country, generally does not attract the public attention. It only means lack of right kind of food, bringing under-nourishment and fostering diseases among the people, but it also slowly eats away the vitality of the nation. It is therefore of much more dangerous consequences to a nation than when it is visited by famine or flood. When the problem of malnutrition was very acute in Vienna after the Great War (1914-18) and in Barcelona during the Civil War in Spain (1936-39), Friends Relief Mission started their relief work and successfully handled this difficult task. The book under review describes the experience of this Mission who carried out the relief work in these two areas for a period of five years in Vienna and three years in Spain. It gives an analysis of the methods of survey, supply and distribution which were systematic, scientific and suitable to the places concerned. One of the striking features of the work of the Mission was that it succeeded in excellently coordinating the efforts of the local Government and the institutions and it was able to rouse interest in foreign countries like Britain and America who rendered substantial financial help. A perusal of the book, we are sure, will be helpful to those who are interested in relief work. We recommend this book particularly to the relief workers in India who will find in it the necessary technique, discipline and the method of organization required to deal with the problems of malnutrition and famine which are chronic to India.—S.G.

THE INDIAN COTTON TEXTILE INDUSTRY (1944 ANNUAL)

Edited by M. P. Gandhi (Gandhi & Co., Jan Mansion, Sir Phiroze Shah Mehta Road, Fort, Bombay, pp. 114, Rs. 5.)

IMPORTANT developments connected with the Indian Cotton Textile Industry during 1943-44 are reviewed in the above Annual, which like its predecessors, contains useful information on the various aspects of the Industry. The main review is preceded by 20 statistical Tables, a graph showing the trend of wages and prices of cotton cloth, raw cotton, stores and grain from 1942 to 1944 and the texts of the various control orders. In Table 15 of the Annual, the per capita consumption of cotton piecegoods in India in 1943-44 is estimated at 15·2 yards against nearly 18 yards in 1938-39. The figure for 1943-44, it is stated, would drop to 12·7 yards if the requirements for the Defence Services are excluded.

In the main review stress is laid on the desirability of standardizing production to ensure increased output, decreased cost and incidentally a great saving in fuel. It is also suggested that in the immediate post-war period, the target for mill production should be 7,200 million yards per annum—an increase of 50 per cent over the present production of mills.

The Annual contains two appendices, the first dealing with raw cotton in India from the production, consumption, import and export aspects and the second with the handloom industry in India in which also copious extracts from the Report of the Fact Finding Committee (Handlooms and Mills), 1943, are given.—D.N.M.

From All Quarters

CHARCOAL FOR POULTRY

MANY of us are familiar with those unattractive looking charcoal biscuits which are frequently displayed in chemists' shops, but sufferers from indigestion who have been induced to try them know how helpful and effective they are, especially in correcting hyperacidity. The knowledge that charcoal is a great aid to digestion has been of inestimable value to poultry keepers, particularly during the war years when digestive disorders among their birds have been very common, due to the wet and sloppy nature of the food which has had perforce to be fed. But the feeding of charcoal to poultry is an entirely new thing. For many years charcoal has been liberally fed on the Continent, and even in parts of Britain it has often been the custom to throw some to the poultry.

Reference to the British Pharmaceutical *Codex* tells us that 'charcoal has the power of absorbing gases and of removing by absorption many substances from aqueous solutions. It is used internally . . . as an antiseptic and absorbent in . . . intestinal distension, diarrhoea, and dysentery. Its action is partly mechanical, removing mucus and stimulating the movements of the stomach and intestine, and partly the result of the absorption of toxins'. As far as poultry are concerned, the benefits of feeding charcoal are that digestion is aided, scouring eliminated, and loose droppings speedily corrected. All this is reflected in the general condition of the birds and in improved egg production.

Many poultry keepers who have used charcoal have been amazed at the results. One poultry farmer I know who had been feeding large quantities of army swill had experienced considerable trouble on account of scouring. He tried charcoal with immediate and excellent results. After a year he was, owing to a delay in delivery, temporarily provided with a supply, and scouring was immediately renewed on the farm. As soon as the charcoal arrived and had been re-introduced the trouble was rectified. The experience of many other poultry keepers has been the same.

Only pure vegetable charcoal should be given to poultry, and it should be included with the morning and evening feeds to the extent of one per cent by weight of the total feed—2 tablespoonfuls for every 12 birds per feed, approximately. Either fine or granulated charcoal may be given. In the former case it is usually mixed up with the mash, and in the later it is usually fed separately in a hopper in the same way as grit. Charcoal may also be given to rabbits, pigs and goats, with the same satisfactory results as with poultry.—John Harvey in *The Scottish Farmer*, Vol. LIII, No. 2762, November 17, 1945.

COMMON ABNORMALITIES IN PIGS

FOUR common abnormalities in pigs cause financial losses to commercial producers and to the pure bred breeder, says R. M. Hopper, Dominion Experimental Farm, Brandon, Man. The most common of these is known as chryptorchidism. This abnormality in male pigs causes one testicle to be retained in the body cavity, hence only one is found in the scrotum at the time castration normally takes place. The carcasses of chryptorchid or 'ridgling' pigs cannot be used in export shipments of bacon and are discounted up to eight dollars depending upon the weight. The second common abnormality is rupture, either in the scrotum or the belly. Due to the frequency of strictures in the intestines of ruptured pigs, death losses are usually high. Normal carcasses from such pigs are not discounted when rail graded. Hermaphrodites, or double sexed pigs, are less common but sufficiently numerous to cause losses. Rudimentary or inverted nipples in females is the fourth common physical abnormality among swine. The number of pigs that can be nursed by a sow is limited by the number of her normal functioning teats.

The exact way in which the different abnormalities are inherited is so far not fully understood. There is, however, evidence to show that all four abnormalities are hereditary and can only be eliminated by careful selection of breeding stock. Breeders should aim to eliminate from their herds all litters that include abnormal pigs, as well as the sire and dams that produced them.

Purchasers of breeding stock should fully

investigate the whole litter from which the selection is made. Both boars and gilts should be selected only from sound litters. An examination should be made of the gilts as well as the dam to determine if the teats are normal in shape and number. Only by continuous and rigid selection can the herd be kept free from abnormalities. Breeders of pure bred pigs should not use in their own herds, nor offer for sale, breeding stock from litters that include abnormal pigs.—*Department of Agriculture, Canada.*

NOTE ON COOPERATIVE FARMING

THE experiment of cooperative farming was taken up only very recently in two areas in Muzaffarpur district. The first experiments are being made at places where cane-growers' cooperative societies are fairly well established, viz. Bithouli and Silout. Generally the old members of the society or societies volunteer to have the experiment made with their plots and where there are intervening plots belonging to non-members, these are also included in the scheme, but with their specific consent. Under the existing bye-laws all agriculturists can come in as members of the society.

These societies have formed a sub-committee to carry on this experiment of cooperative farming under the guidance of departmental officers. At Bithouli 45·76 acres of land in one bloc and at Silout 44 acres in two blocs have been voluntarily placed at the disposal of societies for cultivation purposes. The growers, both members and non-members, have signed a contract to this effect and they have retained their right to ownership over those plots as before. They have further agreed not to make any change in their right over those plots without the consent of the society. The society through the sub-committee, will carry on cultivation in the best possible manner with the full cooperation and assistance of the growers concerned. The help rendered by the growers will be duly accounted for and suitable return will be given to them out of the produce which will be debited towards the cost of cultivation. The members have agreed to contribute on this basis. The marketing of produce will be done just like sugarcane if desired by the members concerned and cash will be paid to them.

The Funds of the societies have been placed at the disposal of the sub-committee to finance this experiment and they have been also advised to borrow both short-term and long-term loans either from their own Central Marketing Union or the Provincial Cooperative Bank or the Government. The Joint Registrar has been pleased to sanction them Rs. 200 each out of Rs. 1,000 placed at his disposal for meeting the initial expenditure and the Government have been further approached by Joint Registrar to place 1·62 lacs of rupees which represents the saving in the compensation fund, at his disposal for the purpose. The societies are not in a position to incur heavy capital expenditure at present and that is why the Government is being approached for necessary financial help. The immediate needs in these societies are for wells for irrigation and constant and regular supervision by the officers of Agriculture Department.

The sub-committee and the managing committees of the societies will actually supervise the operation of this scheme in close contact with the Government staff of the cane-growers' cooperative societies in charge of the area. One supervisor of cane-growers' cooperative societies has been deputed at each of the two societies specially for this work.

The two societies are reported to be carrying on marketing of sugarcane for some years in the past on cooperative line most successfully.

The land has been surrendered to societies by growers for cultivation which is being done on behalf of the societies on cooperative basis. To demarcate the individual possession of each member-grower, the entire bloc has recently been surveyed by an amin and a map of each individual holding together with the necessary details these plots has also been prepared for guidance in future.

Labour is paid for at the market rate in cash if so desired or the same is credited to the account of the person concerned. The surplus resources of the growers both in man power and cattle, or implements or even farm yard manure, etc. are given preference over the ordinary hired labour of outside growers who are only required to make up shortage, if any.

After meeting the cost of cultivation and paying the charges of rent or renveue over the land, a provision has been made for depreciation and the repayment of loan by instalments which might be 10 to 20 per cent of the saving. The rest of the produce will be shared by the grower members on the basis of their land

areas proportionately in kind or if it is to be sold and the cash value to be appropriated by the members, the sale will be effected cooperatively.

Besides these two societies of Muzaffarpur, three cane-growers' cooperative societies of Champaran, viz. Churiharwa, Pandey-tola and Jhakra, have also started this experiment of cooperative farming in 98 acres, 9 acres and 10 acres of land respectively.

About measures to be adopted to accelerate consolidation of holdings and to prevent fragmentation in future, the author may mention that an attempt was made in the past to carry out experiment regarding the consolidation of holdings on a cooperative basis in two of the Government Estates, viz. Khurda and Bettiah. The experiments were failures and the concensus of opinion was that consolidation of holdings was not possible under the existing Tenancy Laws and the conservatism of the agriculturists. The biggest obstacle is anticipated from the landlords. It may be argued that even if some of the landlords agree, there is no justification for the Government to spend money on staff as there is no return. From the Punjab, it is reported that consolidation of holdings has materially improved the areas and consequently the produce. The Government took advantage of this at the next settlement; the increased revenue made up for the money that was spent. But in a permanently settled area, like Bihar, the Government cannot get anything out of the increased revenue. The author is of opinion that once multi-purpose whole-village societies are organized and are run in a healthy condition, we might try consolidation as an experiment in suitable areas.—Rai Bahadur R. K. Prasad, *Registrar, Cooperative Societies, Bihar.*

WOODHOUSE MEMORIAL PRIZE

IN memory of Mr. E. J. Woodhouse, late Economic Botanist and Principal of Sabour Agricultural College who was killed in actions in France in 1917, a prize in the form of a Silver Medal and books of a combined value of Rs. 100 will be awarded to the writer of the best essay on a subject to be selected from the list noted below. The length of the essay should not exceed 4,000 words.

1. Recent advances in Breeding for Disease resistance in Crop plants.
2. Hybrid Vigour and its application in crop improvement.
3. Polyploids and their production and value in increasing the yield of crops.
4. Vernalization.

The competition is open to graduates of Indian Universities and to Diploma holders and Licentiates of recognized Agricultural Colleges in India, who are not more than 30 years of age on the date of submission of their essays.

Papers should be forwarded to the Director of Agriculture, Bihar, Patna before the 30th June 1946.—*Department of Agriculture, Bihar.*

INDIAN FARMING

ISSUED BY

THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH

Vol. VII | MARCH 1946 | No. 3

MARKETING OF LIVESTOCK PRODUCTS

IT may appear at first thought that 'as a good article sells itself', there should be little justification for the elaborate marketing organizations which have been set up in every progressive country in the world, and that agricultural commodities surplus to the requirements of the producer, because they comprise the necessities of life, could be disposed of without trouble. They can be and have been bartered and sold in one form or another before the civilization of man, while the marketing organizations are of a very modern origin.

We published a short time ago an article[1] which gave an outline of the justification of a government agricultural marketing department in India, its activities and its organization. It was shown there that the ultimate aim of the department was to ensure that the producer gets the best possible price for his wares and that a fair proportion of that price goes into his pocket and is not swallowed by the innumerable intermediaries handling the produce between him and the ultimate consumer. The writer of that article stated that the process involved 'standardization, organization and stabilization'. When this has been accomplished to a satisfactory degree, the necessity of the purchaser to speculate on quality is removed, the expense of unnecessary handling is avoided and an even volume of supply gives confidence to the buyer and strength to the seller.

Of the commodities which a marketing organization has to handle, the most difficult ones are those of a perishable nature. Unfortunately many of the livestock products are of that description, for instance, milk and most of the milk products, eggs and meat, and on that account they offer marketing difficulties of a very special nature. Nevertheless, even these have lent themselves to the ordinary processes of organized marketing and if, in these days, they are to compete in foreign trade, they must be so handled. It was that necessity, in fact, which originated specialized marketing, because the extraordinary improvement which has taken place in modern times in communication and transport, has enabled one country to place its wares at the door, or inside the door, of any other country and thus to open a universal market where a monopoly or advantage, if it is to be held, can be held only on a basis of quality for price. With the fiery competition engendered, goods of doubtful or unreliable quality either lose the market or hold a precarious place in it at a price which compensates the buyer for the risks he takes in purchasing them. Thus a small leaven of inferior stuff pulls down the value of the whole consignment of a sound material to its lower level and, if the consignment is made up of the produce of many sellers, the many suffer for the few. What applies to one consignment applies to the total of each commodity sold from the country or each produce sold within the country.

Two excellent examples of the working of this principle may be cited in the case of the Indian wool trade and the English bacon trade. In the former, it is now well-known that although consignments of wool from this country do include quite a large proportion of medium wool, yet all is classified as East-Indian wool and is sold at a price considerably below its intrinsic worth. That condition has still to be dealt with by modern marketing methods. The second condition arose in the depression years of the early thirties in the United Kingdom when government assistance was being extended to the indigenous pig trade in an endeavour to compete with imported Danish bacon in the home market. English

[1] Bhargava, B.P. (1945), *Marketing of Agricultural Produce in India*, *Indian Farming*, Vol. VI, p. 566

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bacon of some kinds is recognized the world over as being inferior to none, but because of the variability of management and feeding of the English pig then in vogue, the caterer when he or she went to the market, had no assurance that the article bought under a specific designation was the same today as it was yesterday. On the other hand, the quality of the Danish article which had been produced under standard conditions, might be a shade lower than that of the best home produce, but the buyer knew what was being bought and for that assurance was prepared to pay more. The British Government in its attempts to favour the home producer restricted the free import of Danish bacon and increased its price. The buyer however insisted upon having the more reliable foreign material, paid a higher price for it, with the paradoxical result that the foreign country was favoured to the extent that by selling less, it could make more money. In the light of that experience, the whole trade was reorganized by a marketing department of its own and the United Kingdom pig industry put upon a firm and lasting footing.

The marketing departments have been evolved to stand as guardians, to promote the interest of the honest enlightened dealer, to educate the unenlightened, to prevent the tricks of the dishonest producer and dealer, and to reform or eliminate the dangerously incompetent.

In spite of the difficulties in dealing with livestock products marketing departments throughout the world have had many striking successes in the promotion of their sale. One of the first to see the advantages of organized sponsored marketing was probably the South American frozen meat trade. In the early days of the industry the products on the whole were generally of a reliable quality. There were lapses however and suspicion was aroused that all frozen meat was of inferior quality and in some cases diseased. The result was a distinct loss in popularity and consequently of income. The objection was met by the institution of a system of strict inspection by Government experts and a certificate of the class, quality and soundness of the products, which gained and held the confidence of the oversea customers. Another example of a similar action is that which has been taken by the hide trade of East Africa within the last decade. At one time inferior hides only were obtained by the European market from this source, but it was observed that the low price realized did not represent the real value of the product. On enquiry being made, it was found that buyers had to take the good with the bad and, as there was no way of estimating the proportion of each in a consignment, they were prepared to pay only on the assumption that all were inferior. Grading before export immediately enhanced the income through purchase. Grading also brought to light the defects in preparation. The remedy was sought and was applied under the influence of a paying market.

Thus although some 20 years ago three quarters of the hides from Africa were wasted and the best of them could be classed only as indifferent in quality, within the last five years they have formed one of the most important contribution of the British colonies to the war effort. The benefit to Africa of that trade can hardly be overestimated. The stock-farmer is now provided with an incentive to improve the condition of his cattle; it has made him realize for the first time that a small number of good beasts is better than a larger number of bad ones. Better feeding has demanded better agricultural conditions, which, in turn, have led to dairy farming, improved use of manure methods and again better cultivation of the land.

Innumerable examples can be given of the benefits to be derived from organized marketing, but there is no need to do that now, because it has become an established practice throughout the world, so that practically every livestock product which forms a major source of international trade is now dealt with by an official marketing organization for the good of the country as well as for the benefit of the individual.

We have commented more on the influence of organized marketing in foreign trade than upon home commerce, but we do not mean thereby that the benefits which are obtained abroad cannot also be got at home. The confidence of the home buyer must be sought just as much as that of the foreign one if the producer is to obtain full value for his goods and the benefits of a steady market. There are besides equally important duties in assembly, storage, dispersal and disposal which must be efficiently arranged if the graded article is to pass without loss through the process.

As the very foundation of the work, as much knowledge as possible, must be acquired concerning the conditions under which trade operates, and it is for that reason that the

Central Marketing Department of the Government of India, right at the beginning of its career, started the difficult task of acquiring information. As far as live-stock products are concerned comprehensive reports have already been published on the marketing of milk, eggs and hides and skins, while those on wool, cattle and other products are nearing completion. The study of any one of these publications afford an idea of what should be done and what can be done to improve the marketing of that particular commodity. Glaring defects are indicated in the case of some, that of milk for instance, while the more subtle ones are brought to light in the case of others. It is for the marketing departments to analyse the information at hand, to assess the importance of the defects, to diagnose their cause and to suggest and carry through the remedy. In that work they can move only with the good will of the producer, the trader and the consumer.

Original Articles

MARKETING OF SHEEP AND GOATS AS BEASTS OF BURDEN

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AT high altitudes (12,000 to 18,000 ft. above sea level), where excessive cold and arduous climbing render the transport of produce otherwise impracticable, the services of pack animals are taken from sheep and goats. Thus the bulk of India's trade across her over-land routes leading to Tibet and Central Asia is carried on in this way. Similarly the transport of salt from Chanthan salt lakes to Ladakh in Kashmir is effected by sheep. Pilgrims on way to Badrinath also take their rations and belongings on the back of sheep and goats. Each animal carries a load varying from 5 to 20 seers and is harnessed in much the same way as a donkey, i.e. the bag is suspended on either side of its barrel to maintain balance. The average distance covered by an animal is about 10 miles a day.

Pack animals and their breeds

Pack animals are generally selected from stock having robust constitution and thick coat of wool or hair. These qualities are essential to combat the intense cold prevailing in high mountainous ranges and to bear the strain of hazardous journeys over snow-clad and steep routes. Speaking generally, full-grown castrated males of a large size with prominent masculine attributes denoting energy and stamina are selected. In the northern parts of Kashmir, pack animals belong to the *Chanthan* breed of sheep and *Kel* breed of goats. In Lahol and Spiti areas of the Kulu sub-division of the Punjab and the adjoining tracts, the *laddos* (pack sheep and goats) are commonly selected from *Biangi* and *Gaddi* breeds of sheep and *Chigu* breed of goats. They are also known as *Kangra Valley* animals. In the Kumaon Division of the United Provinces, though a large number of locally bred sheep and goats are also employed, the hill traders prefer *Kangra Valley* animals and, to some extent, those from Nepal.

Owing to the extensive use of a large number of sheep and goats as beasts of burden in the Kumaon Division, the succeeding account relates to the pack animals trade in the United Provinces.

Sale centres

Though pack sheep and goats are sold all over the Himalayan ranges, the important sale centres where such animals are marketed in the United Provinces are Haldwani, Kotdwara, Ramnagar, Tanakpur and Jauljibi. *Gaddi* nomads from the Kangra district of the Punjab, Rampur, Busher, etc. visit these places with *Kangra Valley* animals every year by about November-December. They encamp at these markets for two to three months and resume homeward journey in about February. During the course of their stay, *Gaddis* sell sheep and goats to *Juharis*, *Tolchhas*, *Jaunsaris*, *Darmas*, *Vyas*, *Chaudas* and *Nitis* (hill-traders from the districts of Almora, Garhwal and Tehri-Garhwal). These traders are actively engaged in the Indo-Tibetan trade. They make commercial trips[1] to Tibetan markets like Gartok, Gyanima, Taglakot and Nabra in summer and pass the winter months at home. It is during the latter season that they are busy making purchases of pack animals in villages as well as at the above mentioned markets. As *Gaddis* have been visiting the United Provinces since olden times, their relations with the purchasers of this province have been very cordial and it is not uncommon to see animals being sold on credit. Many hill-traders pay the price of their purchases

[1] On their way to Tibet, the Indian hill traders take with them salt, sugar, spices and other articles of daily use. On return, they bring borax, wool, *pashmina* and wool garments.

only in part and clear the balance when *Gaddis* visit those markets again the following year. Thus there often exist running accounts between the sellers and the buyers. Besides these markets, pack animals are also sold in the villages of Almora, Garhwal and Tehri-Garhwal. The local name for a goat is *lakhi* or *khasi* and sheep is called *bakri*.

Supplies

The supplies of pack sheep and goats in the Kumaon Division (Almora, Garhwal, Nainital, and Dehra Dun districts) are derived from two sources, viz. the local population and the imports as shown below:

TABLE I

Population and import of sheep and goats in Kumaon Division

	Sheep		Goats	
	Kangra Valley type	*Local Hill* type	*Kangra Valley* type	*Local Hill* type
Population	146,000	394,000	74,000	410,000
Animals 1-4 years old	102,000	138,000	37,000	82,000
Males 1-4 years old: Total	71,000	92,000	37,000	16,000
Males 1-4 years old: Healthy specimens*	67,000	87,000	35,000	15,000
Imports: From the Punjab	30,000	—	10,000	—
Imports: From Nepal	—	1,000	—	1,000†
Animals available for transport work	97,000	88,000	45,000	16,000

* It has been assumed that about 5 per cent of the animals in a flock are not healthy enough to undertake transport work in hills.

† These animals are quite suitable for pack purposes.

Since transport work is mostly performed by full-grown males, the number of such animals, including the imports from the Punjab and Nepal, has been estimated at 246,000 heads, of which 185,000 are sheep and 61,000 goats. It may be added that of the total animals available for work nearly 57 per cent belong to the *Kangra Valley* type and the remainder are of *Local Hill* type. The latter are not so suitable as the *Kangra Valley* ones, which have a stronger constitution, are more hardy and sure-footed and have a better cold-resisting coat. Besides this, the useful life of local pack animals is shorter than that of those from Kangra Valley or Nepal. Even those *Kangra Valley* animals which have been bred locally are not so suitable as the truer specimens imported annually from the Punjab.

Flocks hailing from the Punjab and the adjoining hill States move towards the United Provinces in a south-easterly direction. After passing through tracts around Simla and the Sirmur State, they go to Rishikesh near Hardwar in the United Provinces. From Rishikesh onwards they follow the Kandi Road and reach their destinations at Kotdwara, Ramnagar, Haldwani and Tanakpur. Most of the imports from Nepal are also received at the latter places.

Demand

It has been ascertained from enquiries in the hills that there is an annual demand for nearly 250,000 pack sheep and goats. The approximate annual strength of Indo-Tibetan movements on the five routes referred to below is 15,000, 10,000, 30,000, 30,000 and 10,000 heads respectively, i.e. a total of 95,000 animals, while the demand for local transport work is about 155,000 animals. Comparing demand with supplies, it is noticed that the former outstrips the latter by 4,000 animals. This deficit manifests itself still further when it is reviewed that local animals are not very suitable for the hard work they are required to perform in hills. Consequently, the supplies of right type of pack animals being far short of their requirements, hill-men have to employ a large number of locally bred animals of an inferior type. In order to make up for this shortage, Indian traders bring with them annually about 1,000 pack animals from Tibet on their homeward journey. They comprise of *huneras* (thick-fleeced rams) and *chelpuses* (*shawl* goats). Since they do not thrive in Indian climate, they are killed for human consumption soon after their arrival in the villages of Almora and Garhwal districts. *Chelpus* and *hunera* skins having a superfine covering are sold locally for making apparel and other fancy goods.

As regards trade movements between India and Tibet, every year in summer (from May-June to October-November), when conditions of communication in hills are better, traders from the Kumaon Division visit Tibetan markets, of which Gartok and Gyanima are most important. The main routes followed are Rishikesh to Gartok (via Tehri and Nilang), Kotdwara to Gartok (via Pauri, Karanprayag and Niti), Ramnagar to Gartok (via Melchauri, Karanprayag and Niti), Haldwani to Gyanima (via Almora and Millam) and Tanakpur to Gyanima (via Askot and Garbyang). All these routes are important from a commercial stand point.

Prices

The principal factor which determines the price of a pack animal is its individuality. This refers to vigour (denoted by massive size), hardiness (denoted by sound legs and feet to withstand the strain of long hill journeys) and thick covering (denoted by long and dense growth of hair or wool as a protection against excessive cold). On account of these qualities *Kangra Valley* animals sell dearer than the *Local Hill* stock, well-fed and castrated animals dearer than the under-fed specimens and entires, males dearer than females, etc. The prices of pack sheep and goats prevailing at markets like Haldwani and Tanakpur prior to the outbreak of the war are given below :

TABLE II

Prevailing prices of sheep and goats

	Price of an ordinary animal	Price of a castrated and specially fattened male
Kangra Valley sheep	Rs. 5 to 11	Rs. 12 to 15
Local Hill sheep	Rs. 4 to 6	Rs. 7 to 15
Kangra Valley goat	Rs. 7 to 15	Rs. 12 to 25
Local Hill goat	Rs. 5 to 9	Rs. 10 to 20

These figures show that the prices of imported animals are anything up to 68 per cent more than those of local stock. Evidence from hill-traders further shows that during times of heavy mortality or famine prices of pack animals shoot up two to three times. The seasonal shortage of animals is usually felt in May-September, which marks the Indo-Tibetan trade season on one hand and is the usual period for the outbreak of *bamka* (contagious pleuropneumonia) among sheep and goats on the other. Traders buying pack animals from *Gaddis* on credit suffer loss, not only by paying high prices as compared with cash transactions but also by giving 12½ to 25 per cent interest on outstanding sums. It may be added that the prices of imported animals being high, many of the poor traders cannot afford to buy such animals, and depend for their requirements on local animals, which are much less economical.

Conclusion

Approximately 250,000 sheep and goats are required annually in the hills of the Kumaon Division for transport work. The supplies of animals for pack purposes being 246,000 heads, there is an annual deficit of 4,000 animals. The annual requirements are high because (a) at high and steep altitudes, sheep and goats are the only animals that can be used as beasts of burden with success and (b) excessive cold and the strain of hazardous hill journeys render pack animals unserviceable very soon, thereby enhancing considerably the annual replacement rate. The demand is met with partly through imports (42,000) from the Punjab and Nepal and mainly from amongst the local stock (208,000). Notwithstanding the fact that the prices of imported animals are high, the total imports are inadequate with the result that hill-men have to use locally bred animals to a large extent. Since the working capacity of local sheep and goats is low and their useful life as pack animals short, they have soon to be killed for human consumption and are replaced every year in very large numbers. Consequently, the majority of hill-men suffer loss.

In view of the large annual demand and short supplies of pack sheep and goats in the United Provinces, it seems desirable to raise locally sheep and goats pre-eminently suited for transport work. One way of achieving this object is the improvement of local flocks by crossing them with selected sires from Kangra Valley. The tracts like Urgam (Garhwal district) may be chosen for forming the nucleus stock of improved animals. In such parts, there is plenty of pasture land, the local people mostly comprise of non-migratory shepherds and the climate is cold. The improvement of local animals by organizing cooperative sheep and goat breeding societies appears more promising. Such societies, if feasible, can also take up the marketing of wool, hair and skins, and endeavour to check skin wastage through disease-roasting and from other causes. Incidentally it may be mentioned that sheep and goats slaughtered in the hills are often roasted with their skin intact. It has been found out from enquiries that the total number of skins so wasted every year is not less than 31,000 pieces.

PLANNING YOUR HOME GARDEN. I

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GARDENING like music is one of the most sensitive of fine arts. A landscape designer should be an artist, an aesthete, a botanist, a gardener and an architect. As an artist he should have an eye for colour and form and as an aesthete, love for nature and beautiful plants. He should also know the anatomy, physiology and ecology of plants, as well as the principles of sculpture, architecture and engineering to appreciate the relationship of plant form and architecture. He should select not only plants which are suitable for the soil, but he should also possess a highly trained aesthetic sense so that he is able to appreciate the principles of balance, rhythm and accent in planting of trees.

Beauty and utility

Beauty and utility should be harmoniously combined, and we must give up the idea that to be useful a thing must be ugly and an object becomes useless as soon as it becomes beautiful. Beauty and utility were at opposite poles a century ago when expensiveness and ornamentation were the chief canons of beauty, and it was thought necessary that a chair or a table must be expensively carved to be beautiful. Now we appreciate that a piece of furniture or crockery can be beautiful and yet simple in design. The ideals of utility and beauty have coincided. Now we realize that whatever is to be designed must perform its function easily, thoroughly and gracefully. In fact all true beauty is functional. The body of a well-developed woman is beautiful because it expresses its function of procreation and maintenance of the species so well. A tea-pot is beautiful when it can contain sufficient amount of hot water and pour it out in a steady stream. A tea-pot from which hot water trickles out drop by drop or in a torrent cannot be called beautiful. Similarly a garden in which trees of all varieties are jumbled together without regard to the colour of flowers, the shape of crowns and the height of plants cannot be called beautiful. A garden is a place for repose and quiet contemplation of beauty and, if its design is such that one experiences a sense of irritation, it is badly designed.

In garden design you have to see that a tree is placed properly and that the right tree is selected. If you place a cheap oleograph of Ravi Varma showing Shiva with serpents coiled around his neck and top-bun in your sitting room, it will make no difference against which window you place it, for it will look equally hideous in all shades of light. If you purchase a Himalayan landscape of Bireshwar Sen, Brewster or Roerich showing the steel grey Himalayan snows after sunset vanishing into darkness or inimitable lonely mystical figures in the mellow star light, you have to be careful where you place it. If you hang it in a heavily curtained dark sitting room or opposite a door where light reflects from the glass of the frame, it is decidedly out of place. So you have to select your picture as well as to select the place in your house to display it. Similarly, you have to select your tree, and also its site. If a dwarf *kachnar* is placed behind a tall *Colvillea*, it is bad design. Design thus deals as much with the placing of the object as with the object itself.

Tree form and topography

Roote and Kelly have defined landscape design as the 'satisfactory and consequently beautiful composition of natural areas—shape of earth, trees and sky—in three dimensions'. Tree form shows remarkable adaptations to topography. We usually find that the shapes of the crowns of trees which grow in a particular locality are adapted to the landscape. Thus the twisted cryptomerias of Japan grow on irregular volcanic rocks, the elongated conifers like the pine, *deodar*, cypress and fir with columnar stems and elongated-globose crowns harmonize with pyramidal mountains of the Himalayas, the semi-globose oaks, chestnuts, maples and apples go so well with the rolling downs and small hillocks of England and France. On the other hand, umbrella-like acacias and *gul mohurs* and semi-umbrella-like neems, mahuas, mangoes, banyans and peepals of the alluvial plains of Northern India are admirably suited to the flat nature of the country. Contrast with these the grotesquely twisted trees of the Vindhyas which grow on inhospitable rocks. This modification of tree shape and crown is possibly

related to light. I have seen columnar pine-like *peepal* trees in congested gardens. A tree with an umbrella or a semi-umbrella-like crown assumes its natural shape when plenty of space is available for the spreading of branches. The linear habit of the conifers is so well-adapted to crowding on a hill-side. Possibly, it originated as a mutation and the resemblance of pyramidal or linear crowns of the conifers to pyramidal mountains is fortuitous. That this peculiar habit is chromosomal in origin is proved by the fact that these trees retain their linear shape even in the plains where there is no crowding in growth and no struggle for light is imposed.

It has been found that a tree from one particular habitat when grown in a different habitat serves as an accent material. Thus a cypress, a pine, a *deodar*, or a Lombardy poplar when grown in the plains serves as a most striking accent.

Accent: According to Roote and Kelly 'Accent is attained by the use of a plant the distinguishing characteristics of which is quite noticeably different from those of the plants which form its setting'. Thus accent may be secured by planting trees and shrubs of a different scale and form than those growing in the locality. A solitary date palm, a *Polyalthia*, a poplar, a *Millingtonia*, a pine, a cypress, a *deodar*, or an *Araucaria* growing in the corner of a lawn serves as an accent material when the other trees and shrubs are low and rounded. Accent may also be produced by using trees with unusual foliage or brilliantly coloured flowers. Thus a solitary *Colvillea* or *gul mohur* serves as an accent material. Accent material should be used sparingly; a mass of tall and unusual trees all clamouring for attention produces a confusion, and a loss of unity occurs.

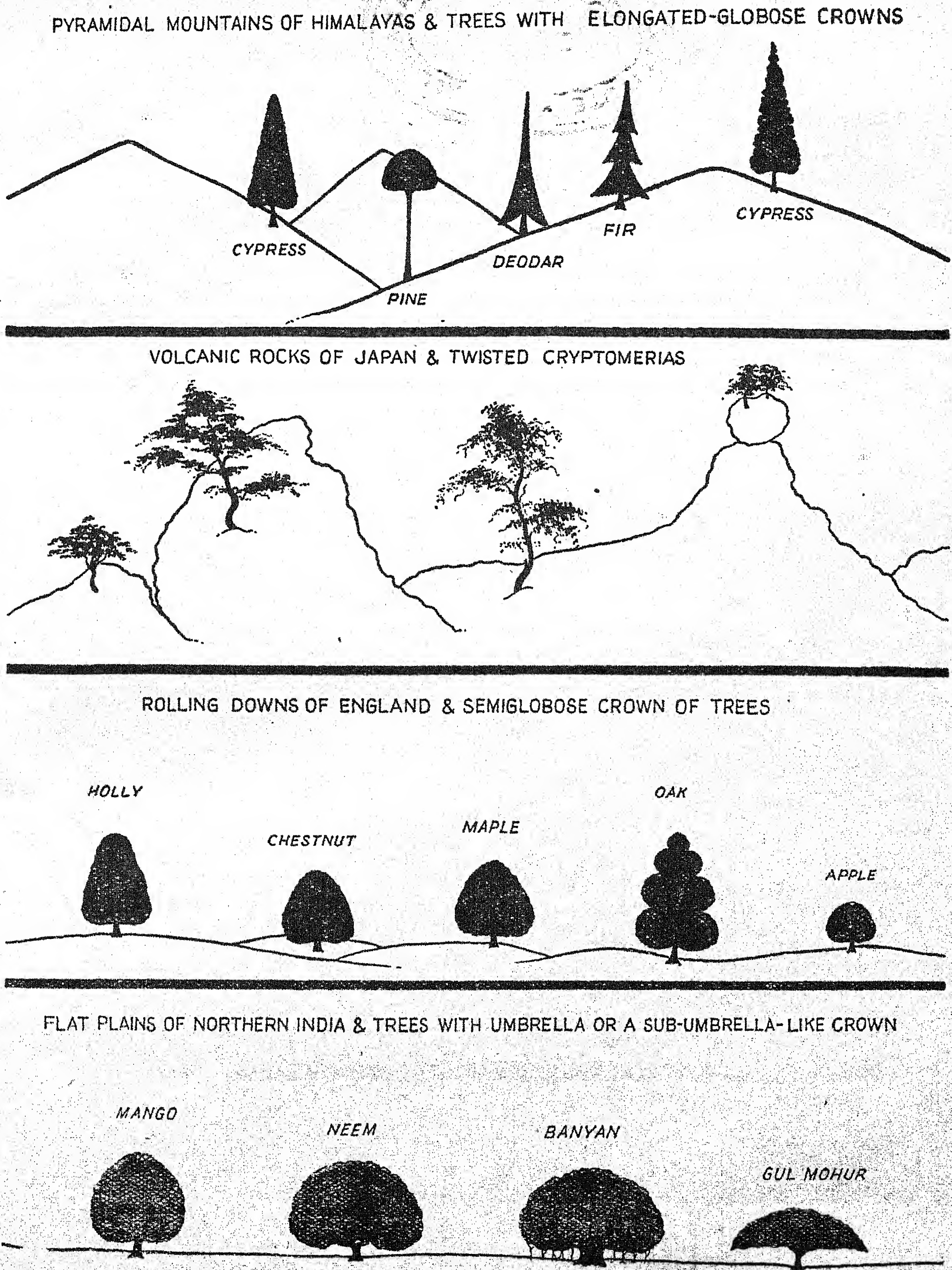
Formal and informal planting

If you ask a person as to what type of planting scheme he would prefer for his house, formal or informal, you will find that, if he is progressively minded, he would invariably go in for an informal design. It is here that we would like to add a word of caution. The words 'formal' and 'informal' when used in relation to planting should be taken out of their social or political context.

Informal planting is suitable for uneven ground and formal planting for flat ground. As Roote and Kelly have defined, 'Informal design may be called a study of space relations, and formal design a study of lines. Informal planting consists of irregular forms irregularly placed, and formal planting consists always of regular forms regularly placed. In a formal scheme straight lines and angles are emphasized on account of their greater precision, while the informal type lays larger emphasis upon curves and rounded masses. In the formal type little is left to the imagination, few unexpected arrangements occur, and the whole scheme is visible from one point, instead of unfolding gradually to the view'.

Formal planting is based on geometrical balance, and informal planting on occult or unsymmetrical balance. Formal arrangement is usually based on bilateral symmetry and use of trees with regular and symmetrical crowns. Moghul gardens with their rows of cypresses are a typical example of formal planting. Formal planting is always used in connection with architecture. It is the architectural element which predominates and the trees used repeat the character of the lines of the building. Mark the resemblance of cypress trees grown in the Taj Mahal with the four columnar towers. Formal planting is particularly suitable for buildings in cities. In cities lines are straight or rectangular and their primness and unnaturalness must be repeated in the garden of the house by symmetrical arrangement of the trees and shrubs, and the use of trees and shrubs with regular shape. In some cases where the crowns of trees and shrubs are not naturally regular, the desired result can be achieved by clipping and pruning. In formal type of design the walks, hedges, walls or bedding are considered as line-divisions. The line being the dominant factor in the disposition of the area, more attention is paid to the arrangement of the material than to its character.

Informal planting is very suitable for houses in our Himalayan belt and in some parts of the Deccan plateau. In this type of planting, the balance is asymmetrical and is a matter of gradual appreciation. In fact an informal type of planting combines a number of independent balances which form a unity. Its beauties and subtleties are gradually unfolded and not thrust all of a sudden before the gaze of the onlooker. The Japanese garden is a typical instance of informal planting. The horticultural element preponderates in this type of planting. Free use is made of shrubs which are placed at unequal distances individually or in groups. Trees are selected for their individual value—beauty of the colour of flowers, their perfume or the charm of their foliage or twisted shapes of their branches.



ADAPTATION OF TREE-FORM TO TOPOGRAPHY

FEEDING OF FARM ANIMALS

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UNDERFEEDING impairs the health of animals, whereas overfeeding strains the animal system and is wasteful. Therefore in order to feed the farm animals adequately and economically it is essential that the ration of the farm animals should be regulated both in quality and quantity. This entails the use of properly balanced rations by which the animal is supplied in its daily diet with the proper amount of all the food constituents necessary to ensure a steady production of weight in the case of young growing animals, milk in the case of milch cattle, energy in the case of working animals, and to ensure a state of maintenance when happen to be dry or doing no work.

Constituents of foodstuffs

The important constituents of food-stuffs are proteins (meat-like substances), fats (fatty and oily substances), carbohydrates (starchy and sugary substances), mineral matter and vitamins. Proteins play a double role and must necessarily be adequately provided in the ration. They are essential for growth, for repairing wear and tear of the tissues and for the production of milk and, in common with fats and carbohydrates, on oxidation in the animal system supply energy for work, keep the animal warm and when fed in excess of the requirement fatten the animal. Mineral matter is chiefly concerned in the making of the skeleton. Vitamins though required in extremely small quantities are absolutely essential and play a unique role in regulating the life processes. In their absence animals inspite of getting other nutrients in adequate quantities suffer from deficiency diseases such as poor growth, rickets, deformed bones and teeth, etc.

Digestible proteins and nutrients

Foodstuffs rich in proteins are legumes, oilseeds and oilcakes, in fats oilseed and oilcakes, in carbohydrates cereals, and in vitamins green growing parts of plants. The animal utilizes only such amounts of the food constituents as it is capable of digesting from a foodstuff. The amounts digested are determined by conducting digestibility trials and for easy computation of rations the nutritive value of a foodstuff is expressed in two terms (a) digestible protein and (b) total digestible nutrients. Total digestible nutrients are calculated by adding up the digestible protein, the digestible carbohydrate and $2\frac{1}{4}$ times the digestible fat, and, as the name implies, this term represents the value of a foodstuff for all purposes. It also forms a useful basis for purchasing concentrates as their market price does not necessarily vary according to their nutritive value on account of which it may be necessary at times to choose one foodstuff in preference to another.

The requirements given in this note both for maintenance and production of different classes of animals are those computed at Lyallpur and the figures along with the feeding values of various feeding stuffs are given in Tables I, II and III. By the help of these tables one can easily compute balanced rations. It should be kept in mind that the ration should be made up of feeds of a suitable nature for a particular class of animals, should be palatable and should contain sufficient dry matter to satisfy the appetite of the animals. Further, it should be as cheap as possible. There should be a sufficient supply of necessary minerals and vitamins in the daily diet in order to ensure normal growth and good production. When a ration is made from a variety of foodstuffs containing sufficient green fodder, there is little chance of vitamins running short.

Acknowledgment

We are grateful to Dr P. E. Lander, M.A., D.Sc., F.R.I.C., I.A.S., the late Agricultural Chemist to the Government of the Punjab,

under whose guidance these experiments were undertaken. Our thanks are due to the Imperial Council of Agricultural Research for the financial help given for determining the nutritional requirements of milch cows and working bullocks.

TABLE I

Requirements for maintenance and production

	Maintenance		For each pound of milk produced	
	Total digestible nutrients in lb.	Digestible protein in lb.	Total digestible nutrients in lb.	Digestible protein in lb.
Cow in milk body weight (800 lb. or 390 sr.)	6·2	0·46	0·36	0·048
Buffalo in milk body weight (1,400 lb. or 675 sr.)	12·2	1·06	0·48	0·066
Working bullock body weight (1,000 lb. or 488 sr.)	7·0	0·57	For ploughing one acre a day and maintenance 9·0-9·5	0·58-0·60

Note :—(i) Approximate body weight can be calculated by the following formula :

$$\text{Body weight in seers} = \frac{\text{Girth in inches} \times \text{length in inches}}{9}$$

(ii) one pound should be taken as half a *seer*.

TABLE II

Feeding values of some Punjab feeds (*concentrates*)

Name of the feed	Total digestible nutrients per 100 lb. of the feed in lb.	Digestible protein per 100 lb. of the feed in lb.
Oilseed		
Cotton seed (*Desi*)	73·0	8·0
Cotton seed *4F*	70·6	10·5
Cotton seed *43F*	89·0	13·7
Cotton seed *285F*	82·9	12·5
Cotton seed *289F*	74·2	11·6
Linseed	108·8	14·8
Sarson seed	104·8	19·8
Soy bean	76·7	34·7
Oilseed cakes		
Cotton seed cake (Undecorticated)	72·5	18·0
Groundnut cake	79·1	31·1
Linseed cake	82·6	23·6
Sarson cake	81·6	25·7
Taramira cake	85·6	29·0
Til cake	94·0	38·3
Toria cake	74·0	30·5
Grains and their by-products		
Arhar	67·7	13·1
Bajra	54·3	4·9
Chari	73·7	6·4
Barley	70·8	6·7
Gram	79·6	12·4
Guara	72·8	28·8
Maize	70·5	5·4
Matri	68·7	18·4
Moth	72·3	17·4
Oats	66·9	4·5
Rawan	62·3	18·6
Rice bran	62·9	8·2
Wheat	84·0	5·8
Wheat bran	70·8	8·9
Wheat *mamni*	54·9	6·5

TABLE III

Feeding values of some Punjab feeds (*Roughages*)

Name of the feed	Total digestible nutrients per 100 lb. of the feed in lb.	Digestible protein per 100 lb. of the feed in lb.
Straw and hay		
Berseem hay	50·0	9·0
Jowar hay	43·0	1·7
Maize hay	44·0	2·7
Oat hay	52·1	1·7
Rice straw	39·0	.. Non-maintenance
Wheat *bhusa*	45·0	do.
Dry grasses		
Anjan grass	34·6	3·0
Ambala "	29·4	2·3
Dalhousie "	29·9	0·6 Non-maintenance
Dub "	36·4	5·5
Ferozepur "	32·1	4·9

FEEDING OF FARM ANIMALS

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UNDERFEEDING impairs the health of animals, whereas overfeeding strains the animal system and is wasteful. Therefore in order to feed the farm animals adequately and economically it is essential that the ration of the farm animals should be regulated both in quality and quantity. This entails the use of properly balanced rations by which the animal is supplied in its daily diet with the proper amount of all the food constituents necessary to ensure a steady production of weight in the case of young growing animals, milk in the case of milch cattle, energy in the case of working animals, and to ensure a state of maintenance when happen to be dry or doing no work.

Constituents of foodstuffs

The important constituents of food-stuffs are proteins (meat-like substances), fats (fatty and oily substances), carbohydrates (starchy and sugary substances), mineral matter and vitamins. Proteins play a double role and must necessarily be adequately provided in the ration. They are essential for growth, for repairing wear and tear of the tissues and for the production of milk and, in common with fats and carbohydrates, on oxidation in the animal system supply energy for work, keep the animal warm and when fed in excess of the requirement fatten the animal. Mineral matter is chiefly concerned in the making of the skeleton. Vitamins though required in extremely small quantities are absolutely essential and play a unique role in regulating the life processes. In their absence animals inspite of getting other nutrients in adequate quantities suffer from deficiency diseases such as poor growth, rickets, deformed bones and teeth, etc.

Digestible proteins and nutrients

Foodstuffs rich in proteins are legumes, oilseeds and oilcakes, in fats oilseed and oilcakes, in carbohydrates cereals, and in vitamins green growing parts of plants. The animal utilizes only such amounts of the food constituents as it is capable of digesting from a foodstuff. The amounts digested are determined by conducting digestibility trials and for easy computation of rations the nutritive value of a foodstuff is expressed in two terms (a) digestible protein and (b) total digestible nutrients. Total digestible nutrients are calculated by adding up the digestible protein, the digestible carbohydrate and $2\frac{1}{4}$ times the digestible fat, and, as the name implies, this term represents the value of a foodstuff for all purposes. It also forms a useful basis for purchasing concentrates as their market price does not necessarily vary according to their nutritive value on account of which it may be necessary at times to choose one foodstuff in preference to another.

The requirements given in this note both for maintenance and production of different classes of animals are those computed at Lyallpur and the figures along with the feeding values of various feeding stuffs are given in Tables I, II and III. By the help of these tables one can easily compute balanced rations. It should be kept in mind that the ration should be made up of feeds of a suitable nature for a particular class of animals, should be palatable and should contain sufficient dry matter to satisfy the appetite of the animals. Further, it should be as cheap as possible. There should be a sufficient supply of necessary minerals and vitamins in the daily diet in order to ensure normal growth and good production. When a ration is made from a variety of foodstuffs containing sufficient green fodder, there is little chance of vitamins running short.

Acknowledgment

We are grateful to Dr P. E. Lander, M.A., D.Sc., F.R.I.C., I.A.S., the late Agricultural Chemist to the Government of the Punjab,

under whose guidance these experiments were undertaken. Our thanks are due to the Imperial Council of Agricultural Research for the financial help given for determining the nutritional requirements of milch cows and working bullocks.

TABLE I

Requirements for maintenance and production

	Maintenance		For each pound of milk produced	
	Total digestible nutrients in lb.	Digestible protein in lb.	Total digestible nutrients in lb.	Digestible protein in lb.
Cow in milk body weight (800 lb. or 390 sr.)	6·2	0·46	0·36	0·048
Buffalo in milk body weight (1,400 lb. or 675 sr.)	12·2	1·06	0·48	0·066
			For ploughing one acre a day and maintenance	
Working bullock body weight (1,000 lb. or 488 sr.)	7·0	0·57	9·0-9·5	0·58-0·60

Note :—(i) Approximate body weight can be calculated by the following formula:

$$\text{Body weight in seers} = \frac{\text{Girth in inches} \times \text{length in inches}}{9}$$

(ii) one pound should be taken as half a *seer*.

TABLE II

Feeding values of some Punjab feeds (*concentrates*)

Name of the feed	Total digestible nutrients per 100 lb. of the feed in lb.	Digestible protein per 100 lb. of the feed in lb.
Oilseed		
Cotton seed (*Desi*)	73·0	8·0
Cotton seed *4F*	70·6	10·5
Cotton seed *43F*	89·0	13·7
Cotton seed *285F*	82·9	12·5
Cotton seed *289F*	74·2	11·6
Linseed	108·8	14·8
Sarson seed	104·8	19·8
Soy bean	76·7	34·7
Oilseed cakes		
Cotton seed cake (Undecorticated)	72·5	18·0
Groundnut cake	79·1	31·1
Linseed cake	82·6	23·6
Sarson cake	81·6	25·7
Taramira cake	85·6	29·0
Til cake	94·0	38·3
Toria cake	74·0	30·5
Grains and their by-products		
Arhar	67·7	13·1
Bajra	54·3	4·9
Chari	73·7	6·4
Barley	70·8	6·7
Gram	79·6	12·4
Guara	72·8	28·8
Maize	70·5	5·4
Matri	68·7	18·4
Moth	72·3	17·4
Oats	66·9	4·5
Rawan	62·3	18·6
Rice bran	62·9	8·2
Wheat	84·0	5·8
Wheat bran	70·8	8·9
Wheat *mamni*	54·9	6·5

TABLE III

Feeding values of some Punjab feeds (*Roughages*)

Name of the feed	Total digestible nutrients per 100 lb. of the feed in lb.	Digestible protein per 100 lb. of the feed in lb.
Straw and hay		
Berseem hay	50·0	9·0
Jowar hay	43·0	1·7
Maize hay	44·0	2·7
Oat hay	52·1	1·7
Rice straw	39·0	.. Non-maintenance
Wheat *bhusa*	45·0	do.
Dry grasses		
Anjan grass	34·6	3·0
Ambala ,,	29·4	2·3
Dalhousie ,,	29·9	0·6 Non-maintenance
Dub ,,	36·4	5·5
Ferozepur ,,	32·1	4·9

Name of the feed	Total digestible nutrients per 100 lb. of the feed in lb.	Digestible protein per 100 lb. of the feed in lb.
Janeva grass	25·9	.. Non-maintenance
Jhelum ,,	41·7	1·6 do.
Jullundur ,,	27·8	0·8 do.
Jutogh ,,	29·1	0·6 do.
Kasauli ,,	27·9	0·7 do.
Lahore ,,	31·6	1·4 do.
Murree ,,	25·1	0·6 do.
Musal ,,	29·4	0·4 do.
Rawalpindi ,,	27·1	0·8 do.
Sialkot ,,	26·9	1·8
Green fodders		
Bajra	12·8	0·9
Barley	14·3	2·3
Berseem	10·0	2·2
Elephant or Napier grass	11·7	0·6
Guara	12·0	2·4
Guinea grass	12·2	0·8
Jowar or *chari*	21·0	0·8
Maize	15·0	1·0
Oats	10·9	1·2
Senji	13·2	2·7
Sudan grass	16·0	0·4
Sugarcane (katha)	23·7	.. Non-maintenance
Sugarcane (tops)	19·3	0·4
Sun flower	10·7	1·8
Turnip leaves	10·9	1·2

From data given in Tables I, II and III, it is now easy to compute rations for different types of animals and a few examples of balanced rations are given below as illustrations :

I. *Ration for a cow of 800 lb. body weight and giving 16·0 lb. of milk*

		Total digestible nutrient	Digestible protein
		lb.	lb.
Maintenance		6·20	·46
For producing 16·0 lb. of milk		5·76	·76
	Total	11·96	1·22
		lb.	lb.
Wheat *bhusa*	8·50 lb.	3·82	..
Berseem green	40·00 lb.	4·00	·88
Bran	3·0 lb.	2·12	·27
Bajra	3·0 lb.	2·01	·13
	Total	11·95	1·28

II. *Ration for a bullock of 1,000 lb. body weight and ploughing one acre a day with the* desi *plough*

		Total digestible nutrients	Digestible protein
Requirements for work and maintenance		9·0-9·5 lb.	0·58-0·60 lb.
		lb.	lb.
Wheat *bhusa*	10 lb.	4·5	..
Maize green	16 lb.	2·4	0·16
Gram	2 lb.	1·6	0·25
Cotton seed cake	1·0 lb.	0·7	0·18
	Total	9·2	0·59

III. *Ration for a buffalo of 1,400 lb. body weight and giving 20 lb. of milk*

		Total digestible nutrients	Digestible protein
		lb.	lb.
Maintenance requirements		12·2	1·06
Requirements for 20 lb. of milk		9·6	1·32
	Total	21·8	2·38
		lb.	lb.
Wheat *bhusa*	20 lb.	9·0	..
Berseem green	60 lb.	6·0	1·32
Gram	2 lb.	1·60	0·25
Toria Cake	1 lb.	0·74	0·30
Bran	1 lb.	0·70	0·09
Cotton seed (43F)	4 lb.	3·56	0·55
	Total	21·60	2·51

One must not look upon these standards as a hard and fast rule to be followed at all times but only as a guide with reference to the particular feeds available and the kind of animals to be fed.

Dry matter per cent in dry roughages and concentrates should be taken 90 per cent and in green fodder 20 to 25 per cent according to the stage of the fodder at which it is cut.

SOILS OF INDIA AND SOIL SURVEY

S. P. Raychaudhuri, D.Sc., F.R.I.C.

Soil Survey Officer, Imperial Agricultural Research Institute, New Delhi

THE objects of the soil survey are (i) to classify the soils according to their characteristics, (ii) to show their distribution on maps, and (iii) to describe their characteristics particularly in reference to the growth of various crops and plants. The ultimate purpose is to provide accurate soil maps, which would show the location and extent of the various kinds of soil.

So far in India, soil survey has not been carried out on any systematic or planned basis. The scattered work that has so far been carried out may be divided into four broad categories:

1. *Soil classification from geological point of view:* In this system the soils are grouped according to the geological character of the rocks which underlie the soil.

2. *Land assessment classification:* This system has been used mainly by Settlement Officers and is based on the suitability of soils for certain crops under local conditions. The main factors which govern such a system of classification are the texture, colour, availability of water and yield of crops.

3. *Soil classification from physico-chemical properties of surface samples:* The classification is based mainly on the contents of nitrogen, phosphorus and potassium useful to plants, i.e. on the nutrient status, lime content and the mechanical composition of surface soils and subsoils. Such classifications are in the nature of soil reconnaissance and have been generally carried out from an agronomic point of view.

4. *The genetic classification:* In this system soils are divided into groups depending on their origin and development. The soil profile is taken as the basis of study. Such studies have been carried out mainly in connection with irrigation or afforestation projects and in one or two instances for agronomic purposes.

All these investigations which have been so far carried out in India are rather scanty, considering the vast area of the country and, besides, most of these surveys have not been carried out by standardized methods.

Soil map of India

No accurate soil map of India is available so far. Such a map can be drawn only by the coordinated efforts of a large number of soil workers distributed all over the country working for a long time. It is recognized that such a type of survey will entail a heavy expenditure and will require a very long time, even if the coordinate activities of soil scientists all over India were marshalled. It is, however, a very fundamental work which should be taken in hand as early as possible. In the first instance it involves provision for the training of men in methods of soil survey and thus creating a nucleus of soil surveyors which will develop the principles on which the ultimate soil survey will be carried out.

Classification of Indian soils

The soils of India may be broadly divided into the following classes:

1. Red soils including red loams, yellow earths, etc.
2. Laterite and lateritic soils.
3. Black soils of varying types, including the typical black cotton soils or regurs.
4. The so-called alluvial soils including deltaic alluvium, coastal alluvium and inland alluvium. The group is an ill-defined one the actual classification of which will depend on an elaborate study.
5. Mountain and hill soils.
6. Arid or desert soils.
7. Saline and alkaline soils.
8. Peaty and other organic soils.

Of the above classes of soils, the most extensive are (1) the red soils, (2) the laterite soils, (3) the black soils, and (4) the so-called alluvial soils. A brief account of the occurrences and properties of these four extensive classes is given below.

Red soils

The main features of the red soils, besides their being of a lighter texture and porous and friable structure, are (i) the absence of lime *kankar* and free carbonates, and (ii) the usual presence of soluble salts in a small quantity usually not exceeding 0·05 per cent. These soils cover almost the whole of the Peninsular India outside the area of the Deccan trap and of the

Name of the feed	Total digestible nutrients per 100 lb. of the feed in lb.	Digestible protein per 100 lb. of the feed in lb.
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Gram	2 lb.	1·6	0·25
Cotton seed cake	1·0 lb.	0·7	0·18
	Total	9·2	0·59

III. *Ration for a buffalo of 1,400 lb. body weight and giving 20 lb. of milk*

		Total digestible nutrients	Digestible protein
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Maintenance requirements		12·2	1·06
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	Total	21·8	2·38
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Cotton seed (43F)	4 lb.	3·56	0·55
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The main features of the red soils, besides their being of a lighter texture and porous and friable structure, are (i) the absence of lime *kankar* and free carbonates, and (ii) the usual presence of soluble salts in a small quantity usually not exceeding 0·05 per cent. These soils cover almost the whole of the Peninsular India outside the area of the Deccan trap and of the

narrow strip of coastal alluvium. In fact the red soils comprise practically the whole of Madras, Mysore, south-east Bombay, east of Hyderabad State and a tract running along the eastern part of the Central Provinces to Chota Nagpur and Orissa. In the north the red soil area extends into and includes the greater part of the Santal Parganas in Bihar, the Birbhum district of Bengal, the Mirzapur, Jhansi and Hamirpur districts of the United Provinces, the Baghelkhand Agency of Central India, the Aravallis and the eastern half of Rajputana. Throughout this range, the red soils differ greatly in depth and fertility which under irrigation produce a large variety of crops. These soils are generally deficient in nitrogen, phosphoric acid, humus and lime. The clay fraction of the red soil is rich in kaolinitic type of minerals.

Laterite and lateritic soils

Laterite is a formation peculiar to India and some other tropical countries, with intermittently moist climate. It is characterized by compact to vesicular rock composed essentially of a mixture of the hydrated oxides of aluminium and iron with small amounts of oxides of manganese and titanium, etc. It is derived from the atmospheric weathering of several types of rocks under monsoon conditions of alternating dry and wet periods. It is specially well-developed on the summits of hills of the Deccan, the Central India, the Central Provinces, and of the Rajmahal and the Eastern Ghats, and certain parts of Orissa, Bombay, Malabar and Assam. The soils are deficient in potash, phosphoric acid and lime. On the higher levels these soils are exceedingly thin and gravelly but on the lower levels and in the valleys they consist of heavy loams and clays and produce good crops particularly rice.

Black soils

The main features of the black soils are that (i) their depth varies from one to two or, as sometimes happens, to several feet, (ii) they are loamy to clayey in texture, (iii) they crack heavily in summer, the cracks reaching upto more than three or four feet in depth especially in the case of heavy clays, and (iv) lime *kankar* zone and free carbonates (mostly calcium carbonate) mixed with the soil are present at some depths. These soils are generally rich in montmorillonitic and beidellitic group of minerals. These may be grouped as tropical black earth or tropical tschernosems. These soils are generally suitable for the cultivation of cotton and extend over the greater part of the Bombay Presidency and also to Kathiawar, Berar, the western parts of the Central Provinces, Central India and Hyderabad and some parts of the Madras Presidency including the districts of Ramnad and Tinnevelly. The soils are generally deficient in nitrogen, phosphoric acid and organic matter, but potash and lime are usually sufficient. They are generally felt to be unsuitable for irrigation but investigations carried out by the Madras Government in connection with the Tungabhadra Project and those by the Hyderabad Government in connection with the Nizamsagar Project show that these soils may be irrigated without any deterioration if irrigation be carried out on sound lines.

Alluvial soils

The alluvial soils are distributed mainly in the northern, north-western and north-eastern parts of India including the provinces of Sind, Punjab, the United Provinces, Bihar, Bengal and parts of Assam and Orissa and also in the coastal regions of southern India including the areas of the mouths of the rivers, at which places they are known as the deltaic alluvium. From agricultural point of view these soils are the most important and most fertile amongst all the Indian soils. The whole of the Indo-Gangetic plain is comprised in this area of 300,000 sq. miles. The soils are deficient in phosphoric acid, nitrogen and humus but not generally in potash and lime. They produce a wide variety of crops, including rice, wheat and sugarcane. In Bengal and Assam the alluvial soil has been subdivided into two classes, viz. old and new alluvium which are however mainly geological groupings. The old alluvium which is red soil, is deficient in nitrogen, besides being deficient in phosphoric acid, lime and humus.

Methods of soil survey

The advancement of pedological knowledge has revealed the complex nature of the soil. The Russian workers were the first to point out that for the study of the soil, morphology of the profile should be made the basis. It should also be recognized that soils may vary in their ecological and agricultural characteristics in spite of their similarity in external

features. In such cases, besides the examination of the morphological features, a simultaneous determination of the chemical constituents present in the soils at different horizons together with the determination of corresponding physical properties is necessary.

Soil survey has been highly advanced in Russia, America, England, Australia and other countries. The fundamental point which has been recognized everywhere is that for proper survey the observations are to be carried out mainly in the field to be supplemented by measurements in the laboratory where necessary.

It should be realized that there are many possible systems of soil classification each of which has a value for a particular limited purpose. Thus the earlier classification of soils based on the texture would be quite adequate for practical purposes for a limited area. There was a serious defect in this earlier system in that attention was restricted to the surface soil only. In the modern American system of classification which is a modification of the Russian system, soils have been divided into World Orders into 'Pedocals' and 'Pedalfers' according as to whether there is calcium carbonate accumulation in the profile or not. These World Orders are divided into Groups, Sub-groups according to temperature, latitude and rainfall. The Groups, Sub-groups are again arranged into different categories based on profile characteristics. Soils with similar profile derived from similar material under similar conditions of development are conveniently grouped together as Series which in America are named after the localities where they were first studied. A Series is further sub-divided according to textural variations and the textural distinctions are known as Types. In England the Series system has been adopted with some adjustment. In the soil survey of Wales it has, however, been found convenient to make a preliminary classification into 'Suites' intermediate between World Group and Series. The soils of a Suite are further divided into Series according to the mode of development as reflected in the profile.

For a vast country like India a preliminary rapid reconnaissance survey will be useful followed by detailed planning for surveys in the different provinces and States. As far as possible, attempt should be made to classify Indian soils into World Groups, Series and Types.

Soil survey from the point of view of land utilization survey

The application of the results of soil survey to the problems of practical agriculture is frequently made through the intermediate step of some sort of land classification. A soil map, if properly prepared, becomes the basis on which the plan of land use is built up. For any sound project of land utilization, soil survey should be followed by investigation along certain lines involving other agricultural agencies, such as (i) the study of climate, (ii) the investigation of agricultural problems of the area, (iii) studies in agricultural economics, and (iv) the determination of potential land use. In America four major classes and one miscellaneous class are employed in mapping types of land use as follows: (i) cultivated land, (ii) pasture and grassland, (iii) woodland, (iv) idle land, and (v) urban areas, home sites, etc. Two major types of land conservation surveys are employed, viz. detailed and reconnaissance, and the physical facts determined by the land conservation survey can be evaluated in terms of *land use capability*, which is determined by the knowledge of the soil types.

It must be recognized that the productivity of a soil is the result of management practices. Some soils need only to be ploughed and cultivated to produce good yields. Others may respond little to such simple operations, yet with more intensive practices like fertilization, liming, terracing, drainage or irrigation, or some combination of these, high yields of good quality may be obtained. Proper soil management with the units of soil classification and soil maps should form the basis of any planning of land utilization.

A MEASURE FOR REDUCING DAMAGE TO COTTON BY JASSIDS

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THE physiological trouble known as *tirak* or bad opening of bolls in the Punjab-American cottons can be successfully averted by shifting the sowings of the cotton from the month of May to the month of June. The beneficial effect of this practice has now been established and the damage from *tirak* has been minimized on those farms where the sowings of cotton are now done according to the recommendations[1] made by the Department of Agriculture, Punjab. Though late sowings of cotton are suited to the soil and climatic conditions prevailing in the Punjab, they are not quite immune to some of the biotic factors. The greatest enemy of the June-sown crop is the small green wedge-shaped insect known as Jassid and popularly called *Tela*. In certain years when the weather is humid and warm, it appears in large numbers in the months of August and September. The danger from Jassid is more frequent in the central parts than in the south-western parts of the Punjab. The intensity of attack depends upon a variety of factors. The June-sown crop being tender and succulent at the time when the pest usually appears is more severely damaged than the May-sown crop. The damage to the highly susceptible strains like *289F/K25* and *124F* is greater than to the relatively resistant strains like *L.S.S.*, *289F/43* and *199F*.

The worst Jassid year

The year 1944 proved to be the worst Jassid year on record due to the abnormally heavy rains that fell in the months of July and August. The insect did maximum damage in the month of September in all the districts. The greatest damage occurred to very late sown crops that came on *kalar* or infertile lands due to suppression in growth. The damage was severe because the attack synchronized with the fruiting phase. The leaves curled up and were shed causing a great loss of nutrients which would otherwise have migrated to the bolls. Consequently there was a great reduction in bearing and yield.

Remedial measure

Though Jassid years are of rare occurrence in the Punjab, the insect takes a heavy toll of the crop whenever it appears in large numbers. Since late sowings had to be practised as a preventive measure against *tirak*, which was of more common occurrence in the early sown crops in the Punjab, attempts were made as early as 1940 to point out a suitable remedy to save the late-sown crop from the ravages of this insect.

Observations of plots under June-sowings in several field experiments conducted in 1940-1941, when Jassids had appeared in small numbers in Lyallpur, Sargodha and Montgomery districts, showed one new feature hitherto unobserved. The June-sown crop which had covered the soil before the pest appeared was found to be much less damaged than the crop which could not cover either on account of defective stand or on account of suppression in vegetative growth on *kalar* or infertile lands. This observation suggested that spacing had some relation with incidence of Jassid attack on the June-sown crop. The best method to enable a late crop to cover the ground before the insect generally appeared was to space it close. A simple replicated experiment was, therefore, laid out at Agricultural Farm, Lyallpur, to test this observation in 1941-1942 on the commonly cultivated strain *4F*. The four spacing treatments were : S1 $=1$ ft. $\times 1$ ft. ; S2 $=1\frac{1}{2}$ ft. $\times 1\frac{1}{2}$ ft. ; S3 $=2$ ft. $\times 2$ ft. and S4 $=2\frac{1}{2}$ ft. $\times 2\frac{1}{2}$ ft. The crop was sown on 19 June which is almost the end of the sowing period recommended for the Lyallpur district. Jassids appeared in August and observations showed that the widely spaced crop was badly damaged while the closely spaced plants were affected only to a small extent. There was a steady decline in yield as the spacing became wider and wider. Table I shows that the yield under close spacing was nearly double the yield under wide spacing.

[1] *Leaflet* (Revised) 166 : Department of Agriculture, Punjab, and Dastur (1944), *Indian Farming*, Vol. V, pp. 254-258.

TABLE I

Effect of spacing on yield (Agricultural Farm, Lyallpur)

Year	Date of sowing	Variety	Yields of *kapas* under different spacings in maunds per acre					Critical difference 5 per cent
			1 ft. × 1 ft.	$1\frac{1}{2}$ ft. × $1\frac{1}{2}$ ft.	2 ft. × 2 ft.	$2\frac{1}{2}$ ft. × $2\frac{1}{2}$ ft.	Standard error	
1941–1942	19 June	*4F*	16·79	14·15	11·45	8·03	± 0·84	1·790
1942–1943	21 June	*4F*	16·34	14·85	8·84	8·07	± 0·698	1·417
		289F/124	13·79	8·85	6·03	3·97	± 0·698	1·417
1943–1944	19 June	*4F*	16·01	11·99	8·18	6·37	± 0·933	1·894
		L.S.S.	13·26	10·25	8·86	7·08	± 0·933	1·894

Observations confirmed

In the Punjab : The above experiment was repeated in 1942-1943 season. In addition to *4F*, a highly Jassid-susceptible variety *124F* was included. The previous observations regarding the relation of spacing and Jassid attack were confirmed and the yields were found to decline as the spacing became wider and wider. *124F* gave lower yields than *4F* under all spacings on account of its greater susceptibility to Jassids, and even $1\frac{1}{2}$ ft. × $1\frac{1}{2}$ ft. spacing proved inadequate for this variety to counteract effectively Jassid attack and give high yield. In the year 1943-1944 this experiment was conducted with *4F* and *L.S.S.*, the two commonly cultivated varieties in the Lyallpur tract. The previous observations were again confirmed.

Similar experiments were laid out in the succeeding season at Lyallpur and Iqbalnagar (Montgomery district). To ensure heavy Jassid infestation a hedge of host plants of lady's-finger was grown around each replicate. Besides, 1944-1945 turned out to be the worst Jassid year on record. The close spacing stood the rigorous test very well. The yield results are given in Table II. It is noteworthy that the effect of close spacing is more pronounced on *4F* than on *L.S.S.*, the latter being more spreading in habit.

TABLE II

Effect of spacing on yield (1944-1945)

Station	Date of sowing	Variety	Yield of *kapas* under different spacings		
			1 ft. × 1 ft.	2 ft. × $2\frac{1}{2}$ ft.	3 ft. × 2 ft.
Lyallpur	19 June	*4F*	17·40	14·05	9·82
		L.S.S.	16·90	14·72	12·40
Iqbalnagar	29 June	*124F*	12·40	10·50	5·35

S. E. (Lyallpur) for spacing = 0·976
S. E. (Iqbalnagar) = 1·324

It is thus clear from the results of four years in succession that close spacing is a practical remedy against Jassid attack. Close spacing is a necessary complement to late sowings for higher yields. The increase in yield is due partly to reduction in Jassid attack and partly to the increased number of plants. The actual contribution of each source, however, cannot be separately assessed.

In Sind and Central India : This important finding in the Punjab was tested by proper experiments in Sind and in Central India. A spacing experiment was laid out at Hyderabad (Sind) in the current season. It consisted of four randomized blocks of three spacing treatments, viz. 1 sq. ft. per plant, 3 sq. ft. per plant and 6 sq. ft. per plant. It was also undertaken to study whether the mode of distribution of a given area around the plant exercised any influence on the efficient utilization of the space placed at its disposal. Accordingly for each of the three spacing treatments three different designs of space distribution, viz. 1 : 1 (square), 1 : 2 (rectangular) and 1 : 3 (rectangular) were kept. *M4*, a popular Sind variety, was sown on 6 June which marks the end of the sowing season in this tract.

Due to unusually heavy rains in July and August Jassids appeared in large numbers and attacked the crop under all spacings, but the attack was most severe on widely spaced plants. The attack declined in close spacing and the crop made a rapid recovery while widely spaced plants made little recovery as the attack persisted longer. The relative performance of the different spacings is shown in Table III.

Close spacing gave the maximum yields. It is evident that for yield under late sowings the manner of distribution of space plays a much smaller role than the plant population and 1 : 2 ratio of space distribution should serve under practical conditions.

TABLE III

Effect of spacing on yield in Hyderabad (Sind) in 1944-1945

Mode of space distribution	Yield of *kapas* under different spacings (maunds per acre)			Mean
	1 sq. ft. per plant	3 sq. ft. per plant	6 sq. ft. per plant	
1:1 (Square)	20·14	13·58	7·25	13·66
1:2 (Rectangular)	20·04	12·84	7·30	13·39
1:3 (Rectangular)	18·88	12·62	5·32	12·27
Mean	19·69	13·01	6·62	

S. E. = 1·467

Similar results were obtained in Central India under rain-fed conditions.

Conclusion

The effectiveness of close spacing in reducing damage from Jassids is not only of real practical value but is also of great scientific interest. This observation is in contradiction to the general belief that a thick crop would be liable to greater damage by insect pests than a thin crop. It is nevertheless a fact borne out by repeated experiments in different parts of India. It appears that this fact has not been reported before.

With the present knowledge it is difficult to explain the mechanism by which a closely spaced crop tends to withstand the attack of Jassids while a widely spaced crop sown on the same date succumbs to it. It is very likely that light plays some important role in the life history of this insect and consequently the attack does not persist long in the closely spaced crop which more or less covers the soil by the time the insect appears. The above view is based on the following observations: (1) The insect is attracted to light and (2) under the shade of trees and hedges the attack is less pronounced inspite of the thinness of leaves. Presumably, therefore, for want of sufficient light in close spacing the environments become less favourable for the multiplication and attack of this insect.

In order to obtain the best results from late sowing with close spacing it is necessary to conform to Jassid-resistant strains for very late sowings. For example *289F/K25* and *124F* cannot be successfully grown after 15 June in the Montgomery district and later sowings with these varieties in the Multan district are also exposed to damage of Jassid attack in years of exceptionally heavy rains. Under such conditions *289F/43* should be preferred for very late sowings. Tall growing Jassid-resistant varieties sometimes suffer in yield under very late sowings on account of severe reduction in growth period. For such considerations *289F/43* should not be grown in the Lyallpur district after 15 June.

The need for propaganda for close spacing is now greater than the need for late sowing which is now coming into general practice. A zamindar requires to be educated for adopting closer and closer spacing as the sowings advance in June. It would also be necessary to make suitable alterations in the drill used by him so that it can be adjusted to sow rows at 3 ft., 2½ ft., 2 ft. and 1½ ft. Furthermore, the recommendations with regard to optimum sowing periods and varieties for each district given in *Leaflet* **166** of the Department of Agriculture, Punjab, should be adhered to.

SOME OBSERVATIONS ON THE BIONOMICS AND CONTROL OF PEACH SHOOT BORER IN NORTH-WEST FRONTIER PROVINCE

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and
P. L. Renjhen, M.Sc. (Hons.)

The North-West Frontier Province is very well-known for the excellence of fruits, especially peaches, the cultivation of which has received a great impetus due to increase in civil and army consumption. Observations, however, show that the Buprestid borer (*Sphenoptera lafertei*) is proving very harmful and it is likely that, if not brought under control, it may in the near future paralyse the peach industry of the province. It was recorded in 1938 as a minor pest at Tarnab and its environs. It has by now established itself as a serious pest of peach throughout the North-West Frontier Province.

Distribution

In North-West Frontier Province *S. lafertei* is present in Hazara, Mardan, Peshawar, Kohat, Bannu and Kurrum Valley (Parachinar). It is also very common in Delhi, Karnal, Dehra Dun, the Mussoorie Hills, Hardwar and other parts of the United Provinces and Kashmir. Ahmad has recorded it from Afghanistan. According to Beeson *S. lafertei* attacks *Cedrus deodara*, *Prunus avium* and *P. padus* as well. Peach, plum and cherry plants are attacked most, although apricot and almond are in no way free from its attack.

Life history

In the beginning of spring overwintering larvae begin to pupate and the beetles start emerging out by the middle of March and continue to do so upto May. The beetles feed on the leaves and lay eggs singly in lenticels and crevices, etc. of the bark. The density of the eggs on the bark varies from four to five per square inch and the total approximate population of eggs on a single tree has been calculated to be over 2,000. The egg, when freshly laid, is white, spherical and of the size of a pin head. A few days later it turns black. The incubation period lasts for about twenty days in April. An egg hatches into a legless grub, which directly bores into the bark, under which it feeds, having the egg-shell intact towards the exterior. The larval stage lasts for about two months in summer and about six months in winter. During this period the grub feeds on the underside of the bark and when full-grown bores an oval hole 4 to 6 mm. long and 4 to 5 mm. broad, and about 1 cm. deep into the wood, where it pupates with its head upwards. The full-grown larva is club-shaped and shiny white with a broad head and a tapering tail. The pupal stage lasts for about ten days. The pupa is encased in a thin covering through which the parts of the developing imago are visible. The adult beetles are bronze-coloured. The female is slightly bigger than the male. They are active by day and can perceive the approach of a man from a distance; they either feign death or fly away when disturbed. The pest is active throughout the year and overwinters either as larva or in the full-grown pre-pupal stage under the bark.

Nature of injury

At the Agricultural Research Station, Tarnab, gummosis in peach trees had been a usual phenomenon for long and its increase in incidence could not be attributed to any known cause. It has now been proved that gummosis is mostly due to the attack of the Buprestid borer. The larva soon after hatching bores its way inside and eats the sapwood. As a result of this injury the plant exudation, which collects in the form of a gum globule at the place of entrance of the borer, comes out. The larvae form irregular minute galleries and while feeding in close proximity to each other convert the inner bark into a powdered mass which may be seen coming out of the split bark. The growth of the branches is stopped. The leaves turn pale brown at their tips and also along the margins. The consumption of the inner bark in the form of a ring causes death of the portions above it. Oval holes are visible on the surface of the bark only after the fully formed beetles have come out. Badly riddled bark lacerates

after sometime, exposing the wood with the oval holes on it. The loose bark is also pecked in winter by birds which pick the borers from inside and thus usually expose the wood. If the intensity of attack is very heavy, death of the plant occurs. Partly affected trees may not die but may become barren bearing fruit only when the new branches come out. The attacked branches also give way to the slightest windstorm. The fruit growers thus suffer irreparable losses every year.

Extent of damage

Both the full grown and young plants of the thickness of half an inch are attacked. The young plants succumb in the very first year of their existence, because the stem is riddled and girdled within a short period ; as many as 32 per cent of the trees are recorded to die at this stage. This loss evidently is a very serious set-back to a person planting a new orchard.

Varietal susceptibility

All the peach varieties show high susceptibility except *Elberta* and *Triumph* which resist the attack from 25 per cent to 28 per cent. In plum varieties No. 1 and 3 are greatly susceptible. *Ogan No. 2* and *Labhu* show varying resistance. The apricot is attacked much less in comparison to peach and plum.

Possible methods of control

The pest is kept under check at Tarnab by cutting the attacked branches and burning them. Whitewashing the trunk is ineffective in preventing oviposition. The beetles oviposit both on the limed and unlimed parts. As eggs are laid exposed on the bark, diesel oil emulsion has been used as an effective ovicide. The beetles feed on the leaves before oviposition. Therefore, spraying of the leaves with a stomach poison is likely to poison them. Drainage of the orchards should be especially looked after, because in soils with poor drainage the damage is high. The health of the plants should be particularly maintained by judicious manuring as the healthy plants resist the attack to a considerable extent.

DDT FORMULATIONS

IN processed publication No. 37 the Division of Entomology makes tentative recommendations for the agricultural uses of DDT. They were discussed at a recent meeting of manufacturers in Toronto. In harmony with them and in pursuance of the policy of simplicity and economy in the number of formulations of DDT offered to the public, the Pesticides Administration recommend the following basis for consideration of registrations under the Pest Control Products Act :

1. 'Agricultural Insecticides' means insecticides for use on crops of any kind but not on live stock.
2. A DDT spray powder should contain a dispersal agent.
3. The amounts of DDT permissible as the sole insecticidal agent in an agricultural insecticide should be the following only : 3 per cent, 25 per cent, 50 per cent and the amount present should form part of the brand name.—*Department of Agriculture, Canada.*

GEOGRAPHICAL DISTRIBUTION AND SEASONAL INCIDENCE OF MAIN CONTAGIOUS DISEASES IN THE PUNJAB

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ALL the available records in the Punjab from the year 1932-1933 onwards were analyzed and the yearly distribution of the main contagious diseases was worked out. It is tabulated as follows:

Table I
Yearly incidence of the main contagious diseases

Years	1932–1933	1933–1934	1934–1935	1935–1936	1936–1937	1937–1938	1938–1939	1939–1940	1940–1941	1941–1942	1942–1943	1943–1944
Rinderpest	985	1406	839	604	624	1567	1225	650	122	216	170	294
Foot-and-mouth disease	576	569	552	828	1681	1193	1087	1256	377	1109	679	514
Haemorrhagic septicaemia	580	516	930	1117	1713	1355	1235	1196	1023	1400	2039	1159
Blackquarter	47	49	52	134	264	96	64	79	76	226	328	219

Table I indicates No a decline in the number of outbreaks per year in the case of rinderpest. There is no appreciable decrease in the number of outbreaks in the case of other diseases.

Seasonal incidence

The outbreaks of all the diseases were compounded monthwise to determine the seasonal incidence. Table II shows the number of outbreaks of each disease, in each month of the year:

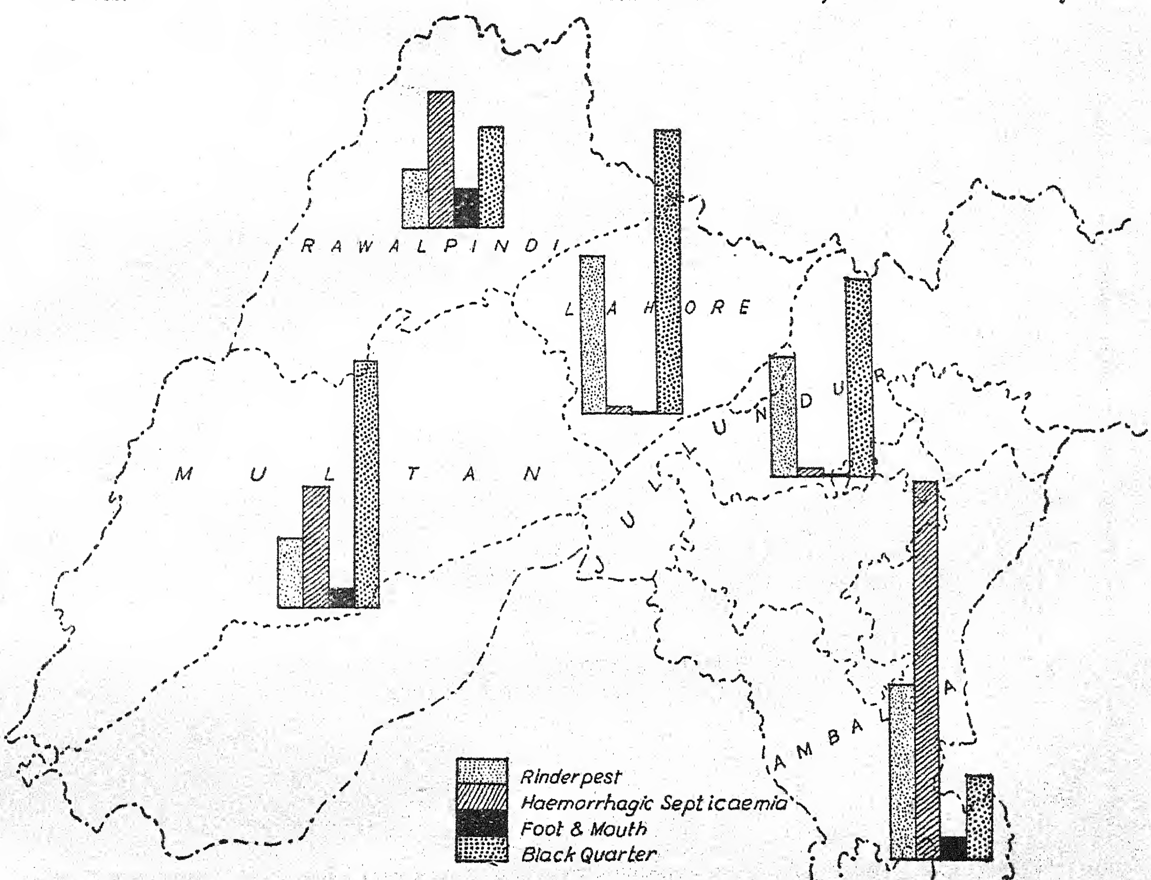

Fig. 1. Incidence of disease in various divisions of the Punjab (Histiogram scale 1″ = 300 outbreaks)

TABLE II

Number of outbreaks of diseases each month

	January	February	March	April	May	June	July	August	September	October	November	December
Rinderpest	1005	712	725	483	745	870	735	648	591	651	596	826
Foot-and-mouth disease	562	545	623	810	1799	950	626	510	409	391	320	571
Haemorrhagic septicaemia	827	902	1009	541	420	332	750	2058	2023	989	674	726
Blackquarter	54	49	74	92	37	29	53	100	99	125	83	68

In the case of rinderpest, the number of outbreaks is more in the cold months of the year, i.e. in December and January. In the case of foot-and-mouth disease the number of outbreaks increases in the warm months of April, May and June. It is stated in Hutrya and Marek, that the disease spreads most rapidly during the warm periods of the year and reaches its acme in the late autumn, while in winter it abates. But in the Punjab it seems to reach its climax in May and starts declining towards the month of June which is the hottest month and reaches a low level in the rainy season.

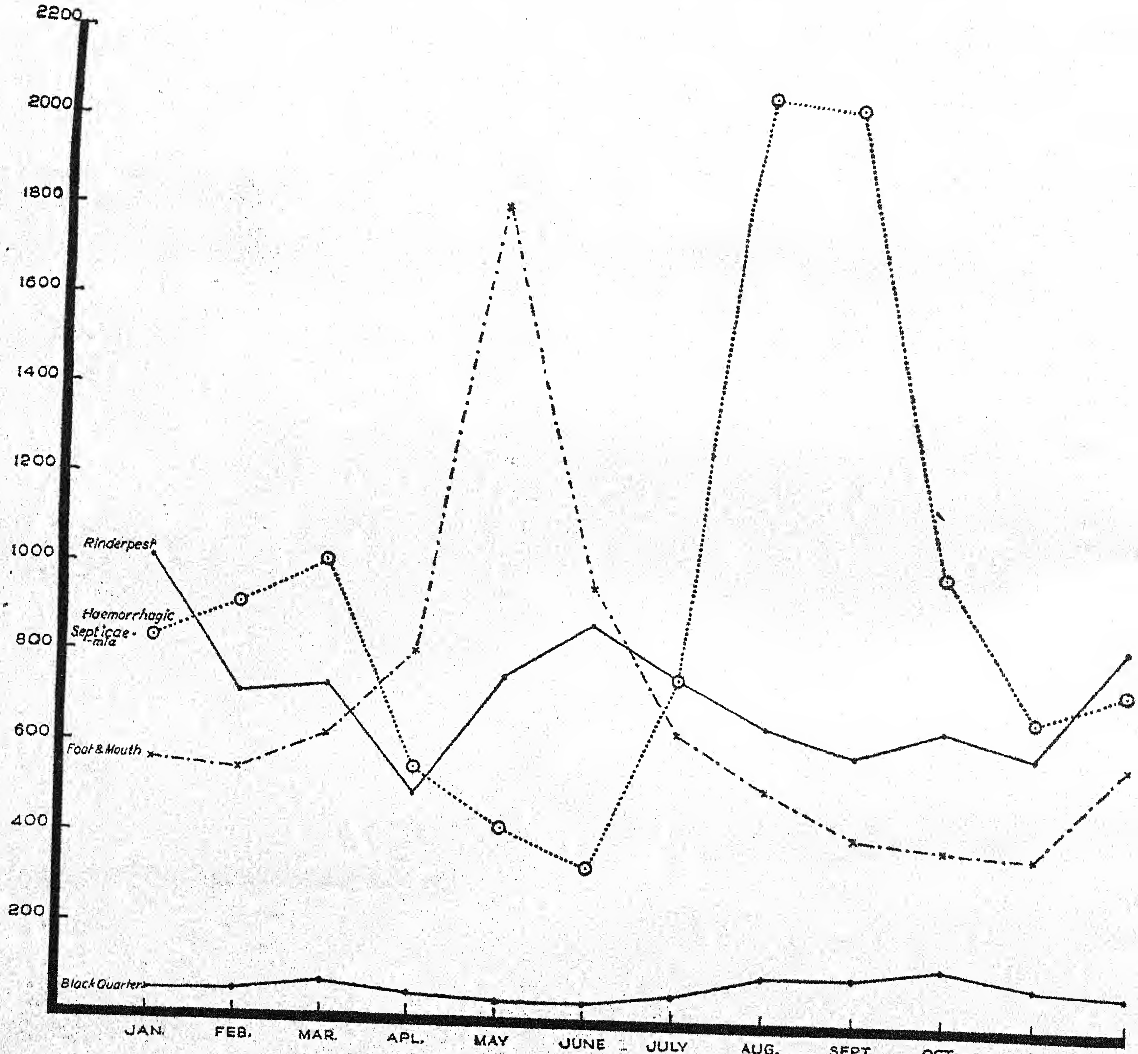

FIG. 2. Seasonal distribution of main contagious diseases in the Punjab

In the case of haemorrhagic septicaemia, the highest number of outbreaks is in the rainy months of August and September and in the early autumn. In spring also the incidence is higher than in the summer and winter months. According to Hutrya and Marek the disease may appear during stall feeding at any time of the year but it usually attacks pasture animals in spring and autumn.

In the case of blackquarter the number of outbreaks is fairly evenly distributed throughout the year but some increase is apparent in the months of August, September and October.

Statistical calculations show that the chance factor, due to which outbreaks might have been more in certain months, is very low. This is indicated by the following Table III.

TABLE III

Statistical significance of the chance factor

Rinderpest

Mean value for December and January = 915·5
Mean value for other months = 677·5

$$t = \frac{915\cdot5 - 677\cdot5}{\sqrt{7226\cdot58}} = 2\cdot800 \text{ significant at 2 per cent level}$$

Haemorrhagic septicaemia

Mean value for August and September = 2040·5
Mean value for other months = 717·0

$$t = \frac{2040\cdot5 - 717\cdot0}{\sqrt{28567\cdot47}} = 7\cdot831 \text{ significant at 0·1 per cent level}$$

In this case, the chances of such a deviation are one in a thousand.

Foot-and-mouth disease

Mean value for April, May and June = 1186·3
Mean value for other months = 511·9

$$t = \frac{1186\cdot3 - 511\cdot9}{\sqrt{28917\cdot6}} = 3\cdot967 \text{ significant at 1 per cent level}$$

Blackquarter

Mean value for August, September and October = 108
Mean value for other months = 54

$$t = \frac{108 - 54}{\sqrt{131\cdot5}} = 4\cdot736 \text{ significant at 0·1 per cent level}$$

The number of outbreaks in each of the five divisions of the province was found by adding up the total number of outbreaks for the last 12 years in all the districts of each division. As the animal population in each division varies considerably, the number of outbreaks per 10,000 animals (bovines only) in each was calculated to get the comparative idea. Calculations were also made on the basis of the population and of area of the whole province. There were about 3·84 outbreaks per 10,000 animals and 2·54 outbreaks per 100 sq. miles as Table IV and the map show.

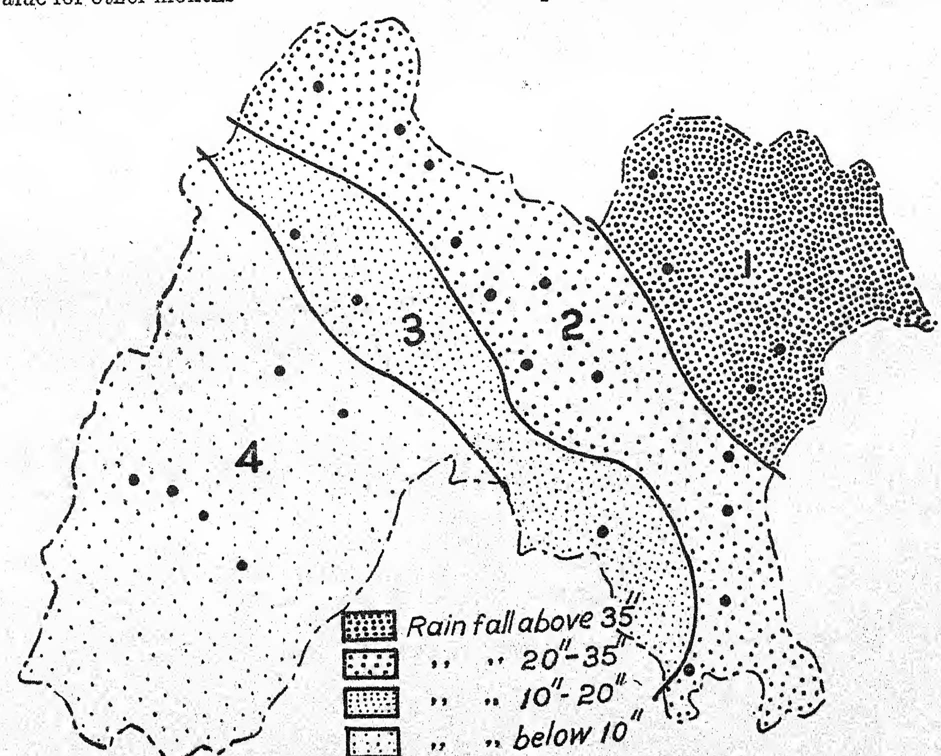

FIG. 3. Rainfall in the Punjab

TABLE IV

Divisional distribution of the number of outbreaks

	Rinderpest	Foot-and-mouth disease	Blackquarter	Haemorrhagic septicaemia	No. of outbreaks per 10,000 animals during the year
Ambala	2762	5954	324	1288	6·64
Jullundur	1878	91	16	3120	2·58
Lahore	1941	7	1	4457	4·14
Multan	1116	2941	372	3944	3·08
Rawalpindi	904	2133	576	1591	3·27

Effect of rainfall

The Punjab province is divided in regard to rainfall into four regions.

1. Above 35 in.
2. 20 in. to 35 in.
3. 10 in. to 20 in.
4. Less than 10 in.

The number of outbreaks in case of the main diseases per 10,000 animals in each of these regions is given in Table V.

TABLE V

Incidence of diseases according to rainfall

Region	Rinderpest	Foot-and-mouth disease	Black-quarter	Haemorrhagic septicaemia
1	4·33	8·1	0·06	5·23
2	13·16	13·13	1·67	16·99
3	12·28	13·26	·05	23·77
4	4·09	10·48	1·58	11·88

This shows that outbreaks of all diseases are comparatively fewer in the region No. 1. It is probably due to the cooler climate and also because of its hilly nature, so that there are less chances of the spread of the disease. Rinderpest seems to occur to a lesser extent in the dry region, while haemorrhagic septicaemia occurs in that region where rainfall varies between 10 in. to 35 in. Blackquarter seems to occur equally well in the rainy as well as in the comparatively dry areas. These generalizations cannot of course apply to sporadic cases.

Other contagious diseases like anthrax, sheep-pox and goat-pox have been reported now and in the province, but their number has been very small.

Acknowledgements

The author wishes to thank Rai Bahadur P. N. Nanda for kindly going through the paper and Mr. N. P. Natu, statistical assistant, for statistical calculations.

DAIRYING IN ENGLAND IN 1849

WHAT was dairying in England like 100 years ago? Then London kept its own cows. Neat loads of trussed hay (often with a sleeping carter atop and the horses following a long convoy of other similar horse-drawn wagons) went to Whitechapel and other markets to feed the horses and cows of the town. Tied all the year round in their sheds, cows were seldom bred again, once they went to London; after being milked for two years or so, they were fattened for the butcher, and fresh milkers brought from the country.

This information is contained in a letter written in 1849 which was published in the *Farmers' Weekly*.

The writer then described the manner in which butter was preserved in those bygone days as follows:

'For every quart of new milk from the cow, the dairymaid takes one pound of potted butter, which has been treated thus the day previous; in two quarts of cold water two tablespoonfuls of vinegar are mixed and the potted butter well-broken and kneaded in it, and then taken out, and served the same in fresh water, in which it is left until the next morning, and then mixed with the milk, put into the churn again, and then treated in the usual way as butter'.

Even in 1849 some method of preserving milk was used, for the letter ends: 'There is a large quantity of milk which undergoes a particular process . . . and is then sent to London, where it is made into a solid substance, so that it is preserved for ships' use'—*Butterfat*, November, 1945.

JUDGING OF AGE BY DENTITION IN GOATS

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JUDGING age is often an important matter in dealing with livestock in general, particularly in assessing the value of animals. It is no less important in the case of goats.

Apparent growth may indicate size or weight but is not a reliable yard stick for assessing the age and maturity of an animal. So stockmen have special ways for judging age fairly accurately when the date of birth of the animal is not definitely known. Again these methods differ from region to region and age to age, with the changes in environment and other conditions. Thus, we observe curled horns in our present domesticated Murrah-buffaloes, differing widely from their ancestors possessing straight long horns for self-defence, thousand years back in their wild condition, in their original home in the North-Eastern tracts of India.

General appearance in relation to age

Under normal conditions of growth the general appearance gives a fair idea of the age of a goat. The goat, while a kid, has baby-fat in the body and a pliable coat; in its youth it exhibits a playful spirit and has a straight vertebrae; the first appearance of mane in the males of certain breeds and of beard in some others is also noticed in this period. From an yearling to the fourth year of life these changes gradually appear and attain their full development. After that the pliable coat turns to a tough and coarse one and the straight vertebrae start drooping at the back of the animal, which finally becomes loose-skinned, stiffed-haired and of an unbalanced gait in the old age. The goat has about 12 to 15 years' span of life under normal conditions.

Growth of horns in relation to age

In the cases of certain goats horn-development may give some idea of age, each horn having one ring mark for every year of life. But in many cases this criterion fails to indicate the proper age, as rings are often developed irregularly and at short distances having no relation to age of the goat. This method again cannot be tried at all on polled and dehorned animals.

Judging by dentition

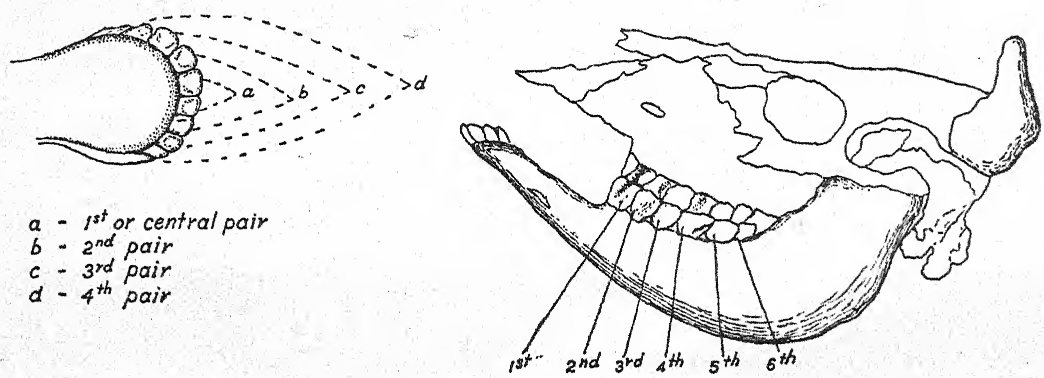
In case of goats Bhatia noted from Etah (U.P.) that at the age of about one year, the central pair of teeth drops out and is replaced by two larger permanent ones. Between the 20th to the 24th month (i.e. at about 2 years of age the second pair appears. In the third year two more teeth come out and in the fourth the last pair (the fourth pair) develops. At seven or eight years of age some of these teeth may become broken or may fall out or they may be knocked out by accident even before that time.

De Valois (1942), Principal, American Arcot Mission Agricultural Institute, Katpadi, South India, writes in his booklet *Milk Goat* (Rural Development Series No. 1) that goats have baby-teeth during the first year. In the second year one pair of larger permanent teeth appears. The second pair appears in the third year and the third pair in the fourth year. Goats, four to five years old, have a complete set of permanent teeth.

Holmes Pegler writes in his *Goat Keeping* that the mouth of goat aged one year contains its full complement of teeth, thirtytwo in number, namely, six molars on either of each jaw, and eight incisors or front teeth, in the lower jaw only. These are of small size and rather pointed. In the second year (generally about the second month) the two centre ones fall and are replaced by two new ones, easily distinguishable by their size, being considerably larger than the other six incisors. In the third year two more small teeth, one on each side of those already changed, are replaced so that at that age there are four large incisors in the centre and two small ones at each end. In the fourth year the large teeth increase to six in number and only two small ones, one at each end, remain. Finally, when the goat reaches her fifth year, the latter in their turn fall and are replaced, and she has then what is commonly called a 'full mouth'. After that time the means of ascertaining the age are

less sure. The only way then left is to examine all the teeth generally but more particularly the molars or grinders—the more these are worn out the older the animal should be presumed to be. At seven or eight years the front teeth begin to wear, and, if much used in barking trees, they break and fall out without being replaced ; so that a goat with one or more incisors missing, the rest being worn out and broken, may be fairly assumed to be an old one and nearly useless, and should therefore be rejected.

To verify the above observations the author studied the Assam and other goats of different ages and types, viz. *Local*, *Jumnapari*, *Bengal Black*, and their crosses whose dates of birth were known. The appearances and conditions of various teeth were noted in relation to age in all classes. About 100 goats were studied, comprising males, females and castrated males. A full-mouthed goat was found with eight incisors in the lower jaw and 24 molars in the lower and upper jaws as shown in Fig. 1.



A B

FIG. 1. Teeth in a full-mouthed goat. A, incisors and B, molars

The appearance of teeth in various ages is given below and also in Table I and Fig. 2.

From birth to one year the temporary incisors have been in use and the mouth of the kid at this age shows these baby or milk-teeth well worn, while in some cases the first pair of broad teeth (permanent incisors) may be cutting.

At one year and three months the first pair of permanent incisors (broad teeth) is cut or may be well up and very seldom the mouth of the yearling shows these permanent teeth in wear.

At about one year and nine months the second pair of permanent incisors (broad teeth) is cut and comes into wear at about two years of age.

At about two years and nine months to three years, the third pair of permanent incisors (broad teeth) is cut and comes into wear sometimes within three months.

At about four years the fourth pair of broad teeth is cut and comes into wear within three months. The goat is now 'full-mouthed', having a complete set of eight parmanent teeth.

At about five years the mouth of the buck or she-goat continues to be 'full-mouthed' with a little more wearing in the central pair.

At about six years marked decaying by wearing is often found in the central pair.

After this age determination of age by an examination of the teeth requires further observation on the rate of wear of the teeth as related to environments, feeds and climatic conditions.

TABLE I

Condition of incisors and molars at different ages

Time of eruption	Incisors	Molars	Remarks
At birth			6 baby-teeth enveloped by thin gum membrane and felt hard when pressed.
4th day	2 milk teeth cut		
5th ,,	4 ,, ,, ,,		
7th ,,	6 ,, ,, ,,	All 12 temporaries	
20th ,,	6 ,, ,, ,,	4th permanent	
1 month	8 ,, ,, ,,	4th ,,	
1 month 15 days	8 ,, ,, ,,	5th ,,	
3 months	8 ,, ,, ,,	5th ,,	
6 months	8 ,, ,, ,,	5th ,,	
10 months	8 ,, ,, ,,	6th ,,	
1 year 3 months	1st pair of permanent teeth cut	1st and 2nd permanent	
1 year 6 months	,, ,, ,,	,, ,, ,,	
1 year 9 months	2nd pair of permanent teeth cut	3rd permanent	
2 years	,, ,, ,,	,,	
3 years	3rd pair of permanent teeth cut	,,	
4 years	4th pair of permanent teeth cut	,,	
5 years	,, ,, ,,	,,	
6 years	,, ,, ,,	,,	Marked decaying and wearing start in the central pair of incisors.

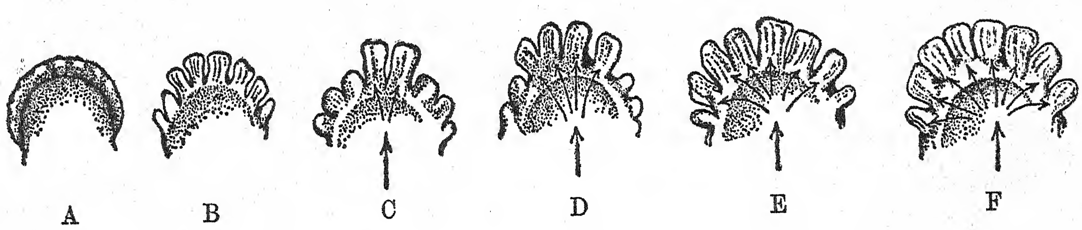


FIG. 2. Dentition of goats from birth to about four years of age. A, kid at birth; B, kid during first year with baby-teeth or milk-teeth or temporary incisors; C, yearling at one year and three months with the central pair of teeth out; D, goat at one year and nine months with the second pair of permanent teeth out; E, goat at three years with the third pair of permanent teeth out; F, goat at four years with the fourth pair of permanent teeth out thus completing the set.

What the Scientists are doing

SCHEME FOR RESEARCH INTO THE DISEASES OF POULTRY, I.V.R.I., IZATNAGAR [1]

THE scheme was sponsored by the Imperial Council of Agricultural Research with the object of training scientific personnel, undertaking a country-wide survey and conducting intensive research on the control and eradication of poultry diseases in India.

Ranikhet disease: The most outstanding result has been the elaboration of a technique for the active immunization of fowls against Ranikhet disease. It has been shown by experimental work that an attenuated virus can be produced which is fully antigenic.

Further work with three Indian strains has revealed marked differences in their amenability to attenuation. In view of the difficulties in carrying out Ranikhet disease work in conjunction with other disease investigation, it was decided to hand over further work on Ranikhet disease to the Pathology and Bacteriology sections of the Institute. A vaccine for use in the field has since been evolved.

Contrary to previous reports, ducks (pennine) proved insusceptible to experimental infection with Ranikhet disease, but work with other breeds is needed to confirm this.

A successful attempt was made to breed fowls resistant to this virus. Chicks hatched from eggs laid by two hens naturally resistant to the virus were shown to be resistant to an experimental infection which proved fatal to controls.

Fowl pox: Studies revealed that the disease occurs all through the year and affects fowls of all breeds. Chicks were more susceptible than older birds. Birds which recovered from the disease were not capable of transmitting infection. All strains collected from the field were found to be immunologically identical.

The practical value of pigeon pox virus, as a vaccine in controlling this disease, has been extensively investigated. A total of 2,793 birds of different breeds and ages were vaccinated and the results recorded. The feasibility of vaccinating day-old chicks was investigated. The results revealed that there was scope for the improvement of the vaccine used in this country and work in this direction is in progress.

Fowl paralysis: A total of 154 samples of morbid materials collected from all over the country was examined histologically. In the course of the survey all the known manifestations of the disease (visceral, neural, ocular and bone) were diagnosed. Cases were met with in Bombay, Punjab, Hyderabad-Deccan, U.P., Cochin, Mysore, Madras and C.P. All breeds including the *desi* were affected, but as the survey was mainly confined to organized poultry farms, stocking primarily the exotic breeds, the extent of its infection in villages is not known. Its existence warrants further survey work, for its presence constitutes a serious threat to the industry as the disease is responsible for heavy losses in other countries.

Fowl cholera: Studies indicate that contrary to common belief the incidence of fowl cholera is rare. The disease is usually endemic in nature and the organisms responsible for outbreaks are of the low infectivity type.

Studies on the viability of fowl cholera organisms (P. *aviseptica*) have indicated that the present technique for sending materials to the laboratory is not entirely satisfactory. Glycerine even in one per cent concentration was found inimical. Contaminating organisms were quickly lethal and summer temperatures hastened the death of P. *aviseptica* in morbid materials. Femur packed in wood charcoal power was found to yield satisfactory results; at 20°C. to 30°C. the organisms remained viable for as long as forty days.

Detailed investigation was undertaken into the carrier problem in the spread of this disease in a flock where fowl cholera was endemic. In an examination of the flock soon after an outbreak both virulent and avirulent organisms (P. *aviseptica*)were isolated from the respiratory tracts of apparently healthy fowls. Some of these carriers were detected in pens where no case of the disease had occurred. Twentyone months after this outbreak, *Pasteurella* carriers were again detected in the flock. These findings indicate the necessity for control by the detection and elimination of the carriers.

Interesting observations were also made on

[1] Final Progress Report of the Scheme for Research into the Diseases of Poultry, I.V.R.I., Izatnagar, (10 February 1939 to 14 April 1944). Abstracts of results having practical application (slightly amended).

the role of avirulent *Pasteurella* isolated from healthy fowls. The results suggest that outbreaks may occur through wild birds like crows picking up mild infection and passing it on to fowls.

A good deal of work was also done on the elaboration of a satisfactory vaccine. No useful results were obtained with cultures of the available strains of P. *aviseptica*. Similar results were obtained from tissue vaccines. Inoculation of fowls with a strain of P. *boviseptica* was, however, found to confer a solid immunity. Further research along this line of work is very essential.

S. pullorum-gallinarum infection: Work was was done on the standardization of an antigen for the rapid whole blood—stained antigen method for the diagnosis of this disease in adult stock. This antigen was supplied to the Assistant Disease Investigation Officers so that they would collaborate in the survey of this disease.

A total of 5,017 adult fowls from 23 different flocks proved negative for the infection. As no confirmation of the presence of the disease could be obtained it is concluded that this disease is either very rare or absent in India.

Ticks: The control of seed ticks (larvae of *Argas presicus* Oken) by the application of kerosene in linseed oil, pyrocide 20-sulphur, iodoform and ash or boric acid, neem oil, naphthalene, and methylated spirit was investigated. Most of these were helpful in the control of seed ticks.

Derris root powder in 10 per cent aqueous suspension recommended as a tickicide was found unsafe for chicks under five weeks old. The toxic effects were in proportion to the extent of body surface covered.

Miscellaneous conditions: Cases of tuberculosis, streptococcal infections, infectious coryza, a variety of tumours, coccidiosis, blackhead, egyptionellosis, favus and infestations with lice, mites, fleas and helminths were diagnosed. More work on the incidence and losses from these diseases is required.

U.S.S.R. DEVELOPS NEW BREED OF DUAL-PURPOSE COW

FURTHER information has come to hand about the new dual-purpose cow now being made available in substantial numbers to State and collective farms in Russia.

This breed which has only been evolved in the last twenty years, produced the cow 'Poslushnitsa' who is claimed to hold the world's record for butterfat output in 300 days—about 1,395 lb.

The yield of the new breed is claimed to average about 500 lb. of fat, the test averaging 3·9 per cent. Body weight has been greatly increased at the same time as milk yield, and their ruggedness had led the Commissariat of Agriculture to plan their introduction to the cold northern regions.—*New Zealand Dairy Exporter*, November 1, 1945.

What would you like to know?

Enquiries regarding agriculture and animal husbandry should be addressed to the Directors of Agriculture and Veterinary Services in provinces and states. This section is reserved for replies to selected letters in cases where it seems that the information may be of general interest.

Q. We are manufacturers of various types of food products and at the moment have interested ourselves in the preservation of eggs. Could you please give us full particulars and advice on the subject ? (P.P.L.)

A. Eggs may be preserved by

(1) Breaking out the internal contents and drying them.

(2) Breaking out the eggs and storing the contents at a very low temperature.

(3) Holding the whole eggs at a suitable low temperature.

(4) Treatment of the shell.

Egg drying: This may be done either by spray drying, pen drying or belt drying.

Frozen eggs: In this method the broken eggs are frozen and stored until required.

Eggs in shells: Eggs in shells can be successfully stored for six months or more at a temperature of 30° F. and a relative humidity of 85 per cent. There are various other ways of treating eggs in shells so as to improve their keeping qualities.

For detailed information a reference may be made to the Officer-in-charge, Poultry Research Section, Imperial Veterinary Research Institute, Mukteswar.—I.V.R.I.

Q. Can you please supply me the following information regarding animal bristles and hairs or refer me to some authoritative publications that deal with it ?

(1) Preparation

(2) Trade varieties

(3) Grading

(4) Packing requirements

(5) Unit of sale

(6) Uses

(7) Bleaching

(8) Dyeing—(C.L.K.)

A. It is suggested that you consult 'Handbook of Commercial Information' (3rd Ed.), published by the Government of India. Copies of the publication may be obtained from the Manager of Publications, Civil Lines, Delhi. If any further information is required you are advised to consult the Director General of Commercial Intelligence and Statistics, Calcutta. —I.C.A.R.

What's doing in All-India

MYSORE

M. MALLARAJ URS, B.Sc., B.Sc. (AGRI.) (EDIN.)
Secretary, Committee for Agriculture, Bangalore

THE failure of the monsoon rains during the last season in the major portion of the State has very adversely affected the production of food. The prospects of the coming harvest are not bright and as there is likely to be considerable food shortage in the State, the Government is taking every step to encourage ryots to grow more food crops in the coming *mungar* (*kharif*) season.

'Grow more food' campaign

In addition to the various concessions in the matter of distribution of seeds and manures granted from time to time in connection with the 'grow more food' campaign, the Government have during the current year, sanctioned further special concessions to encourage ryots to grow more food crops. Tank beds in large reservoirs such as Krishnarajsagar, Kanva, Markonahalli, Vani Vilas Sagar and other lakes where water has receded have been thrown open for the growing of *ragi* and *jola* crops and the Department of Agriculture has made arrangements for the distribution of *ragi* and *jola* seeds to the ryots free of cost. The assessment of eight annas per acre, stipulated in the previous Government Order dated 16 July, 1943, has been waived and that the entire amount of such assessment, not already recovered for the current season on lands on which the above mentioned crops are raised, has been remitted. A bonus of four annas per *pallas* subject to a minimum of one rupee per acre brought under cultivation, will be paid to cultivators raising the above mentioned crops in the area and an additional sum of Rs. 500 may be set apart for grants, by the Deputy Commissioners, of suitable rewards to village officers and leading agriculturists who show good progress in the cultivation of these lands.

To cope with the work in connection with the 'grow more food' campaign a special staff of agricultural inspectors and fieldmen at a cost of Rs. 75,000 has been sanctioned by the Government in the first instance for a period of six months. Recommendations have been sent to the Government for the continuance of the scheme for a further period of two years by which time it is hoped that the food situation will be eased considerably.

Development of lift-irrigation

On the recommendations of the Policy Committee for Agriculture in the matter of development of lift-irrigation by increasing the number of pumps, the Government have sanctioned concessions regarding the sale of electric pumps on hire purchase system by the Electrical Department. A Special Officer has also been appointed to examine this question and submit detailed proposals to the Government. The demand for electric pumps has increased considerably and the Chief Electrical Engineer has placed orders for 60 more pumps. A scheme for the manufacture of electric pumps and motors in the State recommended by the Policy Committee has been sanctioned by the Government. The total cost of the scheme is Rs. 2,00,000.

Policy Committee on Agriculture

The schemes for the development of agriculture, forestry and veterinary services prepared by the heads of Departments were brought up before the Post-War Reconstruction Committee for Agriculture held on 21 September, 1945, and after a full and thorough discussion of the schemes, they were recommended to the Government for adoption. There are 20 schemes for the development of agriculture involving a total cost of Rs. 91·36 lacs of which Rs. 15·4 lacs are non-recurring and Rs. 76·32 lacs recurring. The schemes cover all branches of agriculture, viz. agricultural botany, chemistry, entomology, mycology and engineering. Among those relating to the general section, the important ones are:

(i) *The multiplication and distribution of paddy seeds and manures:* The scheme envisages the distribution of 83,000 *pallas* (100 seers) of paddy seeds and Rs. 37,50,000

worth of manures. A concession of 25 per cent has been proposed by the Committee for the sale of seeds and manures.

(ii) *The distribution of improved agricultural implements:* It is proposed to distribute each year various implements as shown below at a cost of Rs. 17,60,000.

Improved ploughs	20,000
Bullock cane mills	500
Jaggery boiling units	500
Persian wheels	100
Other improved implements	1,000
Spare parts for ploughs, implements and cart materials	20,000

A concession of 33 1/3 per cent is proposed to be given to the ryots in the sale of these implements. The Department of Agriculture has been laying out as usual a number of demonstration plots and subvention farms in ryots' fields. About 3,000 demonstration plots and 130 subvention farms and 600 seed farms covering almost all the crops had been laid out last year. With a view to make this a permanent feature of the Department, a scheme for starting more experimental farms for doing research work on different crops and the laying out of demonstration farms in each taluk headquarters has been drawn up and recommended by the Policy Committee for the sanction of the Government. The cost of the scheme is estimated to be Rs. 18,92,890.

There are 26 schemes for the development of livestock and veterinary services in the State involving a total cost of Rs. 97,66,672 of which Rs. 23,56,400 are non-recurring and Rs. 74,10,272 are recurring. The schemes include training of veterinary personnel, starting of cattle breeding stations, development of sheep breeding, poultry farms and duck farms. The Government have already sanctioned seven schemes. A scheme for training of stockmen at a cost of Rs. 1,26,000 has been sanctioned. Sanction has also been accorded for training of veterinary inspectors in veterinary colleges at Bombay and Madras. Eight schemes for the development of sheep farm in the State at a cost of Rs. 6,61,796 have also been sanctioned.

Development of fisheries in the State

A preliminary survey of the fisheries in the State has been completed and the Fishery Development Scheme has been sanctioned by the Government with a view to increase the production of food fishes in the rivers and lakes of the State and is now being operated in three districts. A scheme at a cost of Rs. 24,000 has been sanctioned by the Government for taking effective conservation and judicious exploitation. Efforts are also being made to improve the economic conditions of fishermen by organizing cooperative societies and giving better facilities for collective fishing, transportation and marketing of fish. Recently the Government have sanctioned another scheme for the establishment of a Fishery Research Station and an aquarium at Krishnarajsagar at a cost of Rs. 1,40,000.

Compost manure from town wastes

The scheme for the production of manure from town wastes sponsored by the Imperial Council of Agricultural Research has been in operation in the State since the beginning of August, 1943. About 40 sanitary inspectors in two batches have been given detailed instructions and practical training and active compost production work has been taken up in over 30 municipalities spread all over the State. Up to end of 1945 over one million cubic feet representing 20,000 tons of compost of good quality had been prepared by these municipalities, and of these approximately 8,000 tons has been purchased by ryots and used on their lands.

Proposals for the extension of the Compost Scheme to cover all the urban centres in the State are under active consideration of the Government. A third batch of sanitary inspectors is due to receive their training in the making of compost. In cooperation with the Public Health Department, it is intended to give instructions to a large number of sanitary inspectors in conjunction with their primary sanitary training so that a very large number of trained men would be available to take up the work in each and every town in the State.

POST-WAR DEVELOPMENT OF ANIMAL HUSBANDRY IN ORISSA

R. L. Kaura, B.V.Sc., M.R.C.V.S.
Additional Director of Veterinary Services, Orissa

WITH a view to overcome chronic deterioration of livestock which has adversely affected the agricultural economy as well as the prosperity and health of the people in the province, the Government of Orissa propose to attack this problem on all its fronts. This potential source of wealth has not been fully appreciated and developed by the people in this province in the past partly due to their ignorance and partly due to the inadequate veterinary aid resulting in prevalence of diseases and pests, the non-availability of pedigreed sires in sufficient numbers resulting in promiscuous breeding and the absence of fodder crops from the general cropping scheme resulting in defective and uneconomical feeding. These factors have been largely attributed to the stunted growth of the livestock rendering them inefficient and economically unproductive. The cows are notoriously poor milkers, the total production and consumption of milk being about 0·5 oz. per head per day as against 25 oz. in the Punjab, Sind, etc. The bullocks are puny and weak and therefore unsuited for making use of modern, efficient and labour-saving implements. The sheep are also small in size yielding only a few ounces of coarse wool per head per annum as compared with 4 to 6 lb. of fine wool in northern India. Other kinds of livestock, e.g. goats, poultry, pigs and horses are also in the same deteriorated condition.

For the efficient and expeditious development of livestock and livestock industries in this province special priority has been given in the first Five-year Post-war Plan of the Government to the training of sufficient number of hands, reorganization of the Department and the production of pedigreed sires in sufficient numbers for the various species of livestock. It is proposed to establish an Orissa School of Veterinary Science and Animal Husbandry for the training of veterinary assistant surgeons (three years' Diploma Course after Matriculation) and stock-men (one year's course after Middle English) and for short practical courses in animal industries, e.g. dairying, sheep breeding and wool utilization, improvement of hides and skins, poultry and eggs, pig rearing, etc. It may take about two years to establish the school during which period it is proposed to depute 10 candidates from Orissa each to the Bihar and Madras Veterinary Colleges instead of four and one respectively and to train 30 stock-men students every year at Cuttack as in the past. Provision has also been made for higher training at the Imperial Veterinary Research Institute (three candidates every year) and at the British Universities (two each during the first and second year and subsequently one) every year. For the efficient and expeditious execution of the plan it is considered necessary to reorganize the Department with a wholetime Director with an Assistant Director at the headquarters and six District Veterinary Officers, a Veterinary Investigation Officer assisted by an Assistant Disease Investigation Officer (Poultry) and an Assistant Disease Investigation Officer (Sheep and Goats) as provided under the Imperial Council of Agricultural Research scheme, a Superintendent of the Veterinary Sera and Vaccine Institute, a Livestock Development Officer assisted by a Dairy Development Officer and a Poultry Development Officer, Sheep and Goat Development Officers as provided under the Imperial Council of Agricultural Research Schemes, an Officer-in-Charge of the proposed Animal Husbandry Bureau assisted by a Statistician and a Publication Assistant and a Senior Marketing Officer assisted by six District Livestock Marketing Inspectors. For the production of pedigreed sires of all species of domestic livestock it is proposed to enlarge the Provincial Livestock Breeding Farm, Angul, in the Cuttack District and considerably increase its foundation stock as well as to establish a District Livestock Breeding Farm in each of the remaining five districts.

To effect mass improvement of cattle and buffaloes in the province both in regard to milk yield and draught capacity it is proposed to establish an intensive cattle and buffalo breeding area in each district which will be supplied with pedigreed Hariana bulls and Murrah buffalo-bulls from the Government Farms at the rate of one per 100 cows or

buffalo-cows. The Government Farms will continue to import fresh blood from the home of the breeds, viz. Punjab every now and then in order to keep up the good qualities at a desirable standard. In these areas legislative measures will be introduced for the compulsory castration of all scrub bulls and buffalo-bulls and for restricting the dedication of bulls on religious grounds to only those approved by the Department. Subsidies will be provided in deserving cases for the maintenance of bulls and buffalo-bulls as well as rams and ducks supplied by the Government. From these areas selected bulls and buffalo-bulls will be supplied to the rest of the respective districts to produce results on a wider scale. A scheme has also been included for the establishment of a Cattle Breeding and Dairying Section at each of the various *goshalas* where good housing facilities and land for cultivation of fodder crops are generally available, and another for establishing subsidized 'mixed' farms in all sub-divisions to be stocked with pedigreed stock in order to increase the local production of milk and pedigree bulls at and around these centres. A scheme for the improvement of sheep and another for the improvement of goats have recently been sanctioned by the Imperial Council of Agricultural Research and will be taken up in the post-war period. It is proposed to establish a piggery each at the Angul Farm and the proposed Russelkonda Farm for supplying pedigree Berkshire boars to the people to grade up their indigenous stock. For a similar purpose a Horse Breeding Section will be established at Angul where Kathiawari stallions, noted for speed and endurance, will be bred for supply to important towns in the province with sufficient horse population where they will be maintained by the Government. A scheme for the development of the poultry and eggs industry and another for the establishment of a duck rearing farm at Kaluparaghat on the Chilka lake where ideal facilities exist for this purpose have also been included.

Realizing the paramount importance of cultivated fodders to the economical production and maintenance of livestock, schemes have been included to encourage the cultivation of fodder crops and for the establishment of 'mixed' farms referred to above. Facilities will also be provided by the Government at these 'mixed' farms for the alkali treatment of rice-straw free of cost with a view to popularize the method in the province as it enhances the palatability, digestibility and nutritive value of the straw. A scheme for the improvement of village pastures and another for the establishment of a small factory for the manufacture of sterilized bone-meal flour for feeding livestock and of bone-meal manure to solve the problem of mineral deficiency in the province have also been included. A scheme for the introduction of economically balanced rations for ryots' cattle in Orissa villages and of flood-resistant varieties of fodder plants in the flooded areas has recently been sanctioned by the Imperial Council of Agricultural Research and will be taken up in the post-war period.

For the more effective and expeditious control of diseases and pests it is proposed to establish three veterinary dispensaries in each sub-division and three stock-men centres under each dispensary, and to provincialize all the veterinary institutions in the province for better management and more efficient working. A mobile veterinary dispensary will be provided for each district which will prove efficient in controlling outbreaks of contagious diseases and providing veterinary aid even to the remotest parts of the district and will also help in animal husbandry propaganda. To facilitate quick diagnosis in the field it is proposed to establish a diagnostic laboratory at each district headquarters. It is proposed to introduce mass immunization of cattle with goat tissue virus which is produced at the provincial veterinary laboratory against rinderpest which alone is responsible for over 50 per cent of the total cattle mortality. To enable the Department to control the contagious diseases more promptly and efficiently it is also proposed to introduce legislative measures for compulsory vaccination and segregation of diseased animals. For the control of ecto-parasites like ticks, lice, mites, etc. and to prevent damage caused by them to hides and skins and to fight the diseases transmitted by them, cattle dipping tanks will be established at suitable *hats* in all the sub-divisions where facilities for drenching animals with a suitable vermicide mixture will also be provided.

In regard to dairying, schemes have been included for the establishment of a subsidized dairy at each district headquarters, colonization of *gowalas* in the neighbourhood of towns to organize milk production on cooperative basis under more hygienic conditions and for the subsidized sale of concentrate cattle-feed in urban areas with a view to augment the production of milk. Yet another scheme that has

been included aims at increasing the production of butter and *ghee* in selected areas, viz. Kujang and Jajpur (Cuttack district), Parlakimedi (Ganjam district) and Nowapara (Sambalpur district). A scheme for the improvement of slaughter-houses and another for the appointment of trained shearers with a view to educate the local shepherds in the art of washing, shearing and dipping of sheep and for proper handling of wool have also been included. A scheme for introducing proper methods of flaying and curing of hides and skins and another for popularizing compost-making in order to utilize more advantageously the dung, urine and waste vegetable matters from the byres are also considered necessary from the animal husbandry point of view and they have been included in the post-war industries and agricultural plans respectively. The proposed Livestock Marketing Organization will try to find and develop suitable markets for improved livestock and their products at remunerative prices which are necessary to keep up the producers' enthusiasm and interest.

Last but not the least important is the education of the general public in regard to the latest scientific and more economical animal husbandry methods so that they may increase their profits from livestock and livestock industries. For this it is proposed to have a net-work of cattle shows in the province, viz. two village shows in each sub-division, a district show in each district and a provincial show at Cuttack. The proposed Animal Husbandry Bureau will serve as a clearing house for all information required by the public on animal husbandry matters and will publish leaflets and bulletins written in a popular style for free distribution to the public. The quarterly illustrated Oriya magazine entitled *Go-mangal Prachar* will be popularized for wider dissemination of authentic information on breeding, feeding and management of livestock and control of their diseases and pests, etc. Advantage will also be taken of the proposed mobile veterinary dispensaries to do propaganda work in addition.

The ultimate goal is to provide a full-fledged College of Veterinary Science and Animal Husbandry in the province with a five years' course leading to a university degree as at Madras and Lahore as well as to establish a Research Institute where facilities for higher training and research work would be available. It is hoped that in due course a veterinary dispensary will be provided in each *thana* (total number, 153) with three stock-men under each dispensary (total number, 459) for providing adequate veterinary aid and to take up successfully the multifarious animal husbandry activities in every part of the province. The province will be made self-sufficient in the matter of pedigreed sires of all kinds of livestock, the problem of feeding livestock will be solved and the various animal industries will be put on sounder and more profitable lines bringing prosperity and health to the people of the province and better return from their land as is the case in some of the other more fortunate provinces in north India.

SIND

L. M. Hira
Marketing Officer, Sind

As Sind is mainly an agricultural province, agricultural cooperative credit societies form the backbone of the cooperative movement. They number roughly about 870. Due to world depression since 1929, the affairs of the agricultural societies had been on the decline, resulting in frozen debts. Vigorous steps were therefore being taken to liquidate the debts and revive the societies. The Department has been working on the policy of concentration and consolidation of the movement, rather than expansion. As a rule no new agricultural societies are being registered unless circumstances warranted otherwise.

In January 1943, the Government felt that the time had come for reviving the activities of the cooperative movement, particularly with a view to afford greater relief to the agricultural masses of the province. With this end in view, the Government appointed a Board called the Cooperative Rehabilitation Board for the province. In pursuance of the recommendations of this Board, two Enquiry Officers were appointed to make a thorough enquiry into the financial position of agricultural societies in Sind.

Experience of the working of the agricultural societies has shown that under the peculiar conditions of Sind, the existing agricultural societies on unlimited liability basis have not proved suitable due mainly to (a) absence of compact villages, (b) difficulty in securing local secretaries on account of general illiteracy, (c) fear of enforcement of unlimited liability principle, etc.

It has, therefore, been deemed advisable to amalgamate the existing societies and bring them at central places so as to secure better management and provide for effective supervision and to form taluka agricultural banks on limited liability basis.

Zemindari cooperative banks

Big landholders are being looked after by separate institutions called Zemindari Cooperative Banks. There are at present six zemindari banks in the province and they are all working satisfactorily and are regularly declaring dividend since past three to four years. The Sind Provincial Cooperative Bank, Ltd., Karachi, is the Central Bank for the entire province. The Bank has framed rules for advancing loans to individuals for current agricultural operations against the security of standing crops and pledge of agricultural produce. The confidence placed in this Bank by the general public can be seen from the facts and figures given hereunder :

Year	Share capital	Reserve fund	Deposits
1941-1942	Rs. 8,90,950	Rs. 11,29,685	Rs. 94,77,776
1942-1943	Rs. 8,29,320	Rs. 12,63,514	Rs. 116,99,278
1943-1944	Rs. 8,31,000	Rs. 13,36,000	Rs. 109,00,000

Cooperative consumers societies

The War brought about changes in the food position of the province, and made the even distribution of available food supplies in the country complicated. Hoarding, high prices, profiteering and black marketing necessitated the adoption of a number of Government measures to deal with them. In spite of the vigilance of the Government some private traders were not slow to exploit the difficulties of the consuming public. This naturally resulted in a revulsion of feeling against the inequity of the distribution system and made the public think of organizing cooperative consumers' stores to meet the situation. There are now 11 cooperative consumers' stores at Karachi, six in the Hyderabad district exclusive of the Hyderabad District Cooperative Purchase and Sale Society. These stores are mainly intended to cater to the needs of their community or a particular class of members, but their bye-laws are wide enough to provide purchase facilities to others as well.

A Central Cooperative Consumers' Stores at Karachi has also been registered recently with a share capital of about Rs. 1,00,000. All the consumers' stores in the city of Karachi and individual persons are eligible for membership. The Central Store will purchase all the necessities of life on a wholesale basis and supply the same to the members for retail selling.

The Hyderabad District Purchase and Sale Society was established with the sole object of purchasing and selling wholesale agricultural products, food stuffs and other necessities of life at prices fixed from time to time by the Controller of Prices, and to distribute the same amongst the members and other consumers in order to suppress or to bring down black markets trading in such articles. After the introduction of rationing in Hyderabad city, this society is now acting as an agent for distributing rationed articles by entering into an agreement with the Government of Sind. In order to finance such huge undertakings, the Society had to raise the authorized share capital from Rs. 2,00,000 to Rs. 5,00,000 out of which a total sum of Rs. 4,50,000 stands subscribed.

During the year ending 30 June, 1944, the Society made a net profit of Rs. 45,289 and declared dividend at 7½ per cent. The total turnover of the Society during the year was Rs. 1,37,78,278-4-11.

Shikarpuri Milk Supply Cooperative Society Ltd.

The Society is the first of its kind in Sind and has been started recently at Karachi with a share capital of about rupees one lakh. The Society has made a good start and at present owns about 100 cows yielding roughly 15 md. of milk per day. The Society has also acquired land near Karachi city.

Fisheries Department

A full-fledged Fisheries Department has been recently set up in Sind. Dr. M. R. Naidu, M.A., Ph.D., formerly of Madras Fisheries Department has been appointed as Director of Fisheries, Sind.

Dr. Naidu has prepared several schemes for improvement of fisheries in Sind such as (a) establishment of Government Fish Curing Yards, (b) manufacture of fish *guano* and fish meal, (c) expeditious transport of fresh fish by motor launches, (d) establishment of experimental smoke houses, (e) development of edible oysters, (f) development of prawn fishery and manufacture of semi-dried prawns, etc.

There are probably few shores in India to which fish resort in greater number and variety than the coast of Sind. Fish is an important item in the dietary of the people and therefore both from economic and public health points of view, the fish industry is of considerable importance to the province. In the post-war period the Fisheries Department is likely to play an important role. Some of the other schemes which are in the offing are:

(1) Stabilizing the fishing industry, (2) deep sea fishing, (3) scheme for Palla hatchery, (4) establishment of marine aquarium, (5) shark liver oil scheme, (6) establishment of fresh water and marine fishery technological and research laboratory, etc.

BIHAR

A. C. Chaudhuri, B.Sc., Ph.D. (Edin.)
Incharge Government Cattle Farm, Patna

THE high prices of cattle still continue. At a recent auction sale held at the Government Cattle Farm for disposal of some off type of cattle it was found that the average range was still four times the rates of pre-war prices. The range of prices of different age groups is given below.

Age	Heifers	Castrated bull calves
	Rs.	Rs.
6 to 12 months	..	50 to 72
12 to 18 months	50 to 95	60 to 90
18 to 24 months	50 to 180	50 to 150
Pregnant heifers	325 to 375	

The Government Cattle Farm which maintains a herd of pure Tharparkar cattle and supplies breeding bulls at concession rates was faced with more demands for such bulls from *gaushalas* in recent times.

A large number of sheep and goats die every year in Bihar from the disease commonly known as *Pitto*, *Gillar*, *Bisi*, *Chherah* or *Petchalli*. The common symptoms of the disease are loss of appetite, diarrhoea, with or without blood and mucus, weakness, inability to stand, thick mucous discharge from the nostrils making breathing difficult, appearance of non-inflammatory swelling at the intermandibular space in most of the affected cases and absence of fever. Death usually occurs in one to two days from the onset of diarrhoea. Sometimes blooting of abdomen and prolapse of rectum in severe cases of diarrhoea are also met with. The size of the intermandibular swelling is very small and insignificant in the morning but it gradually increases in size in the evening. A scheme is in operation since October, 1942, to elucidate the etiology of the disease and to investigate measures for control. The Veterinary Research Officer, *Pitto* and *Gillar*, found that immature *Paramphistomum cervi*, sometimes along with a few *Gastrothylax crumenifer*, was constantly present in large numbers in the duodenum and sometimes in the pylorus of the stomach in almost all the cases of *Pitto* and *Gillar* though certain other parasites were also found in smaller number in many cases in addition. From the experiments so far carried out by him, it is indicated that *Paramphistomum cervi* which is mainly responsible for the production of the disease has an intermediate host which is a snail of the species *Indoplanorbis exustus*. The infection of sheep and goats takes place through the consumption of grass infected with the cercariae.

The following treatment is claimed by the Veterinary Research Officer, *Pitto* and *Gillar*, Bihar, to have given good results. The treatment consists of administering on an empty stomach a few c.c. of 10 per cent copper sulphate solution immediately followed by 2 to 3 c.c. of carbontetrachloride in rice gruel or linseed oil and in the following day by a purgative dose of magnesium sulphate.

In other lands

FEEDING FOR MILK PRODUCTION

PASTURE is the most economical of all crops and its value is probably not appreciated to the same extent in Victoria as in countries where a cold winter climate is experienced and costs of production are greatly increased by the necessity to house and wholly hand feed stock during the winter. In this State, it is taken for granted that dairy cows will remain in the paddocks throughout the year, that for some months the whole of their nutritive requirements will be supplied by grazing only, and that no time in normal years will they have to be wholly maintained with expensive purchased or stored homegrown fodder.

Experience has shown that the best use cannot be made of pastures if cows are allowed continuous access to the whole grazing area throughout the growing season. The rotational system in which the herd is grazed successively in a number of paddocks has not been adopted on many dairying properties, especially those which can be irrigated. Rotational grazing allows pasture in the unoccupied paddocks an opportunity to grow unchecked, and an increase in milk yield is always noted at each change to fresh pasture.

When pastures are luscious and abundant, the average dairy cow will maintain reasonably high production without any supplementary feeding at all, but for some high-producing cows it may be a physical impossibility to graze sufficient pasture to maintain their condition and yield to the full extent of their capacity. For example, a cow weighing 1,000 lb. and yielding 6 gallons of milk would need to graze about 200 lb. of pasture daily. Observations have shown that a cow in the eight hours normally devoted to grazing will consume about 150 lb. of pasture when the sward is dense and four to five inches in height and this amount is reduced as the length of the pasture decreases. Therefore, for maximum production it usually pays to feed high-producing cows a small amount of crushed grain, pollard or some other carbohydrate-rich concentrate.

Luscious spring pastures are rich in protein, and the requirements of even the highest-producing cows will be met by the amount contained in the fodder grazed. It is, therefore, unnecessary to offer them a protein-rich concentrate such as meat meal or linseed meal.

Cows enjoy variety, and a portion of chaff in the bails or some hay in the paddock is appreciated by them. Although the effects of this practice may not be apparent, the dry roughage will help to maintain normal bowel activity. The amount of dry feed should, however, not be sufficiently great to lessen the appetite of the cows for pasture.

Unfortunately, springtime conditions do not continue indefinitely, and on properties where there is no irrigation, the pastures begin to deteriorate and the milk yield declines as the summer progresses. As soon as this is noticed, supplementary feeding should be commenced.

Cows vary in their inherited capacity to produce milk, but the greater yield of the high-producing cow is not due, as is sometimes thought, to its ability to produce more milk from the same amount of food than a poor one. The stimulus to secrete an abundance of milk results in a keen appetite in the good cow, and when the feed is available she will eat more than the low producer. Therefore, if not fed liberally, her yield will decline to the level permitted by the nutrients received. On the other hand, the low producer cannot increase her milk production beyond her inherited capacity and excess nutrients are stored in the form of fat. For this reason, it is a good policy to feed cows according to their production. If all the cows in a herd are fed alike, the good ones will probably be under-fed, and the poor ones over-fed. Profitable production comes neither from cows which are half-starved nor from those that are over-fed, but from those that receive a sufficient quantity of the right kind of food.

The maintenance of milk yield by feeding roughages and concentrates in addition to pasture is profitable up to a certain point and the amounts of supplements should be fed and the point at which further supplementary feeding becomes uneconomical can only be determined by constant observation and calculation.

The Victorian dairying industry is entering

a period which will be marked by a considerable decrease in the number of dairy cows. The only immediate counter to the resultant drop in production will be better feeding to increase the average production of all the cows in the State. If the seasons are favourable and concentrates become more plentiful, there is no reason why this could not be done to the extent of raising production by 30 or 40 lb. of butterfat per cow. Even if the return to the farmer from the additional dairy produce were almost equalled by the cost of purchased feeds and the extra labour needed to bring about the increase, the critical world food situation should warrant the effort.

In addition to adequate feeding, it is essential that a satisfactory water supply should be provided for dairy cows, and as the quantity required varies, it is advisable to give them free access to an unlimited supply of clean water.

Variation in requirements is due to differences in size of the animals, prevailing temperatures, dryness of feed and level of production. Where luscious pastures are being grazed, less drinking water is needed, because such pastures contain about 80 per cent of water. This means that a cow which has consumed 100 lb. of this type of pasture has also taken in eight gallons of water.

Milk contains about 87 per cent of water, so that in the milk of a cow yielding six gallons daily there are five gallons of water. It is, therefore, not surprising to learn that including both the water in their feed and the water they drink, cows consume between four and five pounds of water for each pound of milk they yield. Thus, a cow giving four gallons of milk will require 16 or more gallons of water daily, and the requirements of particularly high producers will exceed 30 gallons.

Milking cows will drink up to ten times a day, and the total amount taken will be more than in the case of cows allowed to drink only two or three times a day. Normally, cows do not drink in excess of their requirements, and as thirst is the best guide, they should, as mentioned earlier, have free access to an unlimited supply of clean fresh water.—Reproduced from *The Journal of the Department of Agriculture*, Victoria, November, 1945.

"NEW WAY" BUTTER MAKING

CHARLES LYNCH

A NEW process for making butter, the "New Way" process, developed in Australia, has some marked advantages over traditional methods.

The butter is made without the usual churning process. The units of the machinery which perform the work comprise a storage and standardizing vat; an extruder, in which the change from cream to butter takes place; a pat moulder for forming one-pound and half-pound prints, and a box moulder for making 56-pound cubes. It is claimed for the process that it reduces capital outlay on factory building and equipment, and also maintenance and labour costs.

In its treatment of fresh cream the casein content is increased from 1·7 per cent to 2 per cent, as against normal butter from acid cream, in which the casein content is 0·75 per cent. As the manufacturing process is completed in an enclosed all-metal plant, the butter produced has a very low bacteria count. While ordinary manufactured butter contains up to ten per cent of air, the "New Way" process reduces the percentage to less than one. During manufacture, while the product is still in the creamy stage, salt in solution is applied, and this enables every drop of the solution to possess an equal content of salt. For this reason, "New Way" butter can be made with greater salt content without actually tasting salty.

The moisture in the butter does not come from water, as in the case of standard butter, but arises from the moisture in the milk itself. This accompanies the fat through all the stages of the treatment, including pasteurization. Thus a dangerous source of contamination is eliminated.

When the new-process butter emerges from the machine at a temperature round about freezing point, it is ready immediately for transport and marketing.

Details of the process, as applied to fresh cream, are as follows:

The milk is centrifuged in the usual way, the objective being a cream of about 40 per cent fat. The cream thus obtained is immediately passed through a pasteurizer, and heated to the usual flash pasteurizing temperature.

After this the temperature of the cream is

reduced to 140 degrees Fahrenheit. It is then passed through another power separator, to produce a cream containing 80 per cent fat. From this separator the cream is delivered into a float valve chamber. It is then drawn by a vacuum into a storage and standardizing vessel.

The primary object in these preliminary operations is to have in the product, in the vacuum-applied storage vat, the allowed fat, moisture, curd and salt in proportions to within a decimal fraction.

The salt has previously been added, in dissolved form, to the cream through the float valve chamber. It thus travels with the cream into the storage vessel where, by means of the agitator, it is thoroughly mixed.

The actual change from cream into butter takes place by extensive chilling and pressure in the course of its movement through the chiller and extruder. It enters the chiller and extrudes in a fluid form, at a temperature of from 110 to 130 degrees Fahrenheit. The finished butter is extruded at the moulding end in prints or cubes.

It is perfectly moulded and ready for wrapping and immediate delivery.—*Australian Agricultural Newsletter*, Release No. AGN /115.

AUSTRALIAN RICE FOR INDIA

NEWS that 20,000 tons of rice which Australia was to send to Britain are to be passed on to India and Ceylon points to the development of rice-growing in Australia. Introduction of large-scale mechanized methods of rice farming enabled Australia at short notice to make an important contribution to the relief of rice shortage during World War II.

The Australian rice industry first met all Australia's rice requirements in 1921, and there was a surplus for export from 1930 onwards. Rice is not, however, a principal item of diet in Australia, and the total amount grown is extremely small in comparison with world population.

The demands of war resulted in a notable venture, when the Commonwealth of Australia Government established a 4,803-acre rice farm in the Wakool irrigation district on the River Murray. Rice disappeared from Australian tables, but production expanded sharply, and Australia's rice crop had an important place in the food strategy of the United Nations east of Suez.

All Australian rice is grown under irrigation, and the industry is highly mechanized. The rice is sown by a combination cultivator-seed drill used for planting other cereals, and harvested by a tractor-drawn, power-driven combination reaper-thresher, which reaps, threshes, and bags in one operation. Each of these Australian-developed and Australian-built machines is capable of harvesting up to 900 bushels of paddy rice a day.

Peak production during the war was in 1943-44, when 40,495 acres yielded 75,065 tons.—*Austral News*, April 1946.

The Month's Clip

SURVEY OF INDIA'S FOOD POLICY IN 1944-45

THE wheel has come full circle, and the Central Food Department completes one more year of food administration and control. An improvement in Government's power to secure control of stocks of foodgrains, the maintenance of prices at carefully calculated levels, the forestalling of local shortages by planned movement of supplies, moving from surplus to deficit areas over 10 lakh tons of rice during the *kharif* year and over nine lakh tons of wheat for the first six months of the *rabi* year, planning better diets, building or helping to build over a million tons capacity of new storage accommodation, establishing a Central Organization to improve standards of inspection and quality, importing wheat on the scale recommended by the Gregory Committee, securing for India an immediate allotment of rice from stocks available in Burma and Siam, and the setting up of machinery to progress the recommendations of the Woodhead Commission for the removal of the threat of famine, and for the creation of a healthy and vigorous population, these are the highlights of food policy during the past 12 months.

Price regulation is the pivot on which the whole scheme of food control turns. The Government's aim has, therefore, been to adjust the prices of foodgrains gradually so as to remove disparities and to strike a delicate balance between the claims of the producer for an adequate return for his labour and an improved standard of living, and the demand of the consumer for cheap food and to hold prices steady without violent fluctuations in either direction.

Maximum prices for rice are in operation all over the country, and statutory maxima have also been fixed for wheat, *bajra* and *jowar*. The statutory maximum price for wheat is Rs. 9–8 in the primary assembling markets in the Punjab and Sind, and Rs. 10-4 in the U.P. In other wheat-producing provinces differentials based on the above figures have been allowed. The price of rice for the season 1945-46 has recently been reduced from Rs. 13-8 to Rs. 12-4 a maund in the Punjab, from Rs. 13-8 to Rs. 13-4 in the U.P. and from Rs. 9 to Rs. 8-12 a maund in Sind.

Reductions have also been effected in the statutory maximum prices for *bajra* and *jowar*, i.e., from Rs. 7-8 and Rs. 7 a maund to Rs. 7-4 and Rs. 6-12 respectively. In addition, to protect the interests of cultivators and support the grain market should there be a fall, the Government of India have renewed last year's guarantee to purchase all wheat offered at Rs. 7-8 a maund, *bajra* at Rs. 5-12 a maund and *jowar* at Rs. 5-4 a maund.

Regulation of distribution

While no guaranteed minimum price for rice is considered possible in view of the present disparities, the rice cultivator is fully assured of a market and is protected by the general guarantee given by the Government in connection with their 'grow more food' campaign.

The logical sequel to the Government regulation of prices is the Government regulation of distribution. India has been described as the 'largest single organized food unit in the world' and, in spite of the vastness of the administrative effort involved and notwithstanding all the defects and difficulties with which it is associated, rationing has made remarkable progress. To-day 533 towns with a total population of 55 million are rationed. The quantum of the basic ration in deficit areas has progressively been raised and to-day, with the exception of four towns, the inhabitants of all rationed areas are assured of a minimum daily food ration of one pound per adult.

The use of the rationing machinery to make special provision for the vulnerable sections of the community, such as mothers and young children, for certain classes of industrial employees with special needs, and for providing, as in the Bombay Milk Scheme, special food for women and children, holds out promise of an achievement far beyond peace-time standards.

One of the principal recommendations of the Foodgrains Policy Committee concerned imports. The Government have imported nearly a million tons of wheat during the year, and for the first time since the loss of rice imports from Burma, India has been allotted 160,000 tons of rice from Burma and Siam. It is also

anticipated that larger quantities of rice will arrive in India during the coming year.

At the same time it must not be forgotten that, for the moment, the needs of countries overrun by the Japanese in the East and the Germans in the West make an exceptional demand on the world supplies of foodgrains, and the allocations are made by the Combined Food Boards in Washington. India, with the rest of the world, is left in an unhappy state of food shortage at the end of the war, and patience, forbearance and self-sacrifice will be needed if food regulation is to ensure adequate supplies and a fair distribution to the hungry nations of the world.

Storage accommodation

The problem of storage is one of the most fundamental which faced the authorities in charge of food administration at the Centre, in the provinces and States. The Government have had to procure, through official machinery normally unaccustomed to trading practices and with practically no trade background, large stocks of foodgrains within a few months after the harvest, so as to prevent the marketed surplus getting into the hands of hoarders. Under such conditions, and owing to the strain on the limited amount of transport available, the losses due to deterioration had increased considerably. While this to a certain extent was inevitable, it was realized that much food could be saved through adequate storage accommodation. To prevent the present waste of food ranks with the production of food as a means of increasing the total resources of the country.

The Government's storage scheme has been designed, to increase with all speed, both temporary and permanent storage accommodation under the control of the Government in markets, at railheads, and in consuming centres; to establish 'buffer stocks' in producing areas; to set up officially controlled inspection agencies; and to encourage with material and advice the construction of private foodgrains storage. The results are impressive. The construction of storage accommodation of approved scientific design, to store 12,00,000 tons of foodgrains has been undertaken. Most schemes have either been completed or are nearing completion. Of this capacity, the cost for 1,60,000 tons has been borne entirely by the Central Government.

The Central and Provincial Governments have shared the expenses, on a 50-50 basis, of another 1,00,000 tons capacity; and of the 2,60,000 tons of storage in which the Central Government are interested, accommodation for more than 2,00,000 tons has been completed. The Provincial Governments are adding, at their own expense, 8,50,000 tons capacity and private enterprise, aided by the Government, about 50,000 tons. In addition, the Central Depot at Karachi, functioning since 1944, can hold 2,00,000 tons of foodgrains. It is interesting to note that the quantity of controlled building materials, i.e. steel, cement, timber, and coal for burning bricks released by the Government for the construction of this storage against applications submitted, amounts to over 1,00,000 tons.

Rescue operations

During the period of food administration under review, various kinds of disasters—floods, drought, temporary failure of local supplies—have had to be anticipated and provided for. Here are a few examples of emergency schemes that were carried through successfully with the cooperation of the War Transport Department and the railway authorities: (1) To meet the acute wheat position in the U.P. towards the end of the *rabi* crop year, about 75,000 tons had to be despatched by special trains from Karachi and other areas to U.P. within a period of two months. (2) To avoid a breakdown in the supplies of wheat products for the fighting forces, large quantities of wheat were moved from Karachi to Northern India in May. (3) In March and April, Delhi would have had to face a severe breakdown in its wheat rationing arrangements, but for the timely arrival of special trains carrying wheat supplies from Karachi.

Reshipping of wheat from one port to another is an expensive operation. Several lakhs of rupees would have been lost to the national exchequer, but for the strict watch kept throughout the period on wheat arrivals from abroad, and the immediate action taken to secure diversion of ships at sea in the light of requirements of wheat at various ports.

Planning better diets

The Famine Inquiry Commission has affirmed that the Government should not only take every possible step to prevent starvation, but must regard it as their duty to improve nutrition and create a healthy and vigorous population. The Food Department has, accordingly, accepted the responsibility of improving the general nutrition of the people by active steps, of

stimulating thought and knowledge on the subject of correct diet, and of improving the supply of individual items of diet which are necessary to remedy deficiences. In the discharge of this responsibility a Planning Section has been set up in the Department, and enquiries which are now being conducted by it should make possible the formulation of a dietary standard for health, based on precise knowledge of the diets of various classes of people in different parts of the country.

It may be possible to conquer famine, the widespread lack of a sufficiency for life; far more intractable is malnutrition, the lack of the right kinds of food which both fosters specific diseases and generally lowers resistance to all. It is recognized that sustained and prolonged efforts are necessary to combat malnutrition, and relief measures must be based on extensive individual enquiry. By enlisting cooperation of specialists in nutrition by the enforcement of priority milk schemes already in operation in many areas, and by various special arrangements for directing supplies to those who most need them, the Central Food Department, can help to lay the foundations of a healthier nation. At this stage, more than that can hardly be expected.

Against the background of the past 12 months we can look at the future. The prospect is not too gloomy, not forgetting the damage done to crops in some parts of the country either by drought or floods. When the *kharif* plan was discussed two months ago, all that the country heard were warnings of a new austerity. Those warnings were wise, but with the expectation of more imports particularly of rice, in which India has had to go extremely short for the past three years, we need not be unduly pessimistic. So far as is known at present, Army demands are not likely to be more than one-third of their previous volume. In 1946, therefore, we can expect a maintenance of the basic ration; a transition from planning for bare sufficiency to planning for better diets; special provision for expectant and nursing mothers; for workers in canteens, for school children, and young people in general. Such measures will return a rich dividend in general contentment.

Until the battle against famine and malnutrition is won, a successful year of food administration is only a milestone. With the end of the war, food regulations become more irksome, but the reasons why their relaxation must be a gradual process are well understood. Economic regulations are the means by which India, as a part of the world organization, must adapt itself to the chaos of the aftermath of war.

Food administration has been a long and difficult process of experimentation. Lessons have been learnt which will reduce its inconvenience and improve its efficiency, in the course of adaptation from the needs of an emergency to the requirements of future prosperity. The prize of success is a working combination of planning and freedom from widespread famine; the penalty of failure is short-lived chaos followed by planning without adequate food.—Reproduced from *Indian Information*, January, 1, 1946.

fundamental causes of soil erosion are economic, for the population of the Punjab foothills is greater than the land can support. This is particularly obvious in the Kangra valley and also in the Murree Hills where the cultivator with only a minute holding of perhaps one acre per family continues to grow crops such as maize, millet and wheat, all of which are essentially suitable for extensive cultivation on large holdings. The salvation of such areas appears to lie in an alteration of the outlook of the cultivator, to turn him away from such crops and to ask him to concentrate upon fruit-growing, vegetable production, bee-keeping and the many other phases of rural reconstruction by which his income from a very small holding can be increased.

The author who held the post of the Chief Conservator of Forests in the Punjab for four years had many opportunities for studying this fascinating problem, and his observations and recommendations should prove of the greatest value as an indication of the lines on which further expansion can best be made. Under the provincial post-war reconstruction scheme of the Forest Department an expenditure of two crores of rupees during five years is visualized, a very large part of which is purely soil conservation work rather than forestry.—R.M.G.

PADDY CULTIVATION

Edited by W. R. C. PAUL, M.A., M.Sc., Ph.D. (London) (Issued by the Department of Civil Defence, Ceylon Government Press, Colombo, pp. 90.)

RICE happens to be the staple diet of people in Ceylon but the production of paddy is not sufficient for her increasing population. About 72 million bushels of paddy will be required to make the island self-supporting with regard to rice. Ceylon depended for rice on Burma, Indo-China, Thailand and India and with the stoppage of supplies from these countries as a result of the World War, the island was faced with a serious shortage. Need was therefore felt for increasing her output of paddy crop. With this end in view the National Food Campaign pamphlets, dealing with paddy, were issued and these were widely appreciated.

The booklet under review is one of the series mentioned above, and has been brought out, as the Civil Defence Commissioner in his foreword explains, 'to give as full information as possible on various aspects of paddy cultivation, with special emphasis on improved method'.

The booklet is divided into twelve chapters, each dealing with a special aspect of paddy cultivation. In Chapter I, an introduction has been given in which the history of paddy cultivation in Ceylon has been traced and the general requirement of rice in the island indicated. The morphological description of the paddy plant is the subject matter of Chapter II and the system of tenure, of Chapter III. The different systems of irrigation are described in Chapter IV. In dealing with floods and drainage (Chapter V) the author aptly draws attention to the question of soil erosion and his warning that 'the exploitation of jungle on hill slopes situated in river basins should cease' is appropriate. A rotational cropping of paddy with other crops has been recommended for controlling incidence of pests and diseases in addition to other advantages (Chapter VI). We are told in Chapter VII that 'paddy is sown throughout the year in different parts of the island, although there are two main seasons'. The problem of manures and soil management has been dealt with at length in Chapter VIII; it is stated therein that 'phosphate is not needed on the average wet zone paddy soil but nitrogen as well as potash are essential on the light and dry zone soils'. The consideration of green manuring could as well have been included in this Chapter but has unnecessarily been postponed to a later Chapter (Chapter XIII). Chapters IX and X deal with varieties and the problem of selection; the author says 'it is, generally, the long-term varieties (6-7 months) that give the highest yield and, wherever possible, they should be grown in preference to the short-term varieties'. The contents of Chapter XI (Plots, Bunds Drains and Channels) could have been included in some other chapter preferably in the one dealing with floods and drainage. Chapters XII-XX have been devoted to the various subjects connected with the cultivation of paddy—the preparation of land, sowing, harvesting, yield etc.; a brief account of the by-products of paddy and the nutritive value of rice has also been included. Pests and diseases are somewhat adequately dealt with in the last two Chapters (XXI and XXII), and measures for their control as well as those for storage have been indicated.

The booklet is a very useful and informative publication and is likely to be of value not only to actual cultivators but also to students of agriculture and the general reader interested in the subject. No conceivable aspect of paddy cultivation has been left out. The booklet is copiously illustrated with text figures and, on the whole, well-printed.—U.N.C.

From All Quarters

EXPERIMENT ON WYNNE GRASS IN SOUTH INDIA TO TEST ITS MOSQUITO-REPELLING PROPERTIES

THE seeds of wynne grass (*Melinis minutiflora* Beauv.) were sown in pots as well as in a finely prepared seedbed. Germination was good only in pots. Later the seedlings were transplanted in an area of about two cents in the field in the month of May, 1943. The plants established soon, but they were not very vigorous in growth. The leaves were pale green in early stages and later the plants became normal in growth and flowered towards the close of the year. In the early stages the plants emitted very light odour but later the odour became stronger. The odour could be smelt from some distance from the place where it was grown. In field observations various insects such as jassids, grasshoppers, beetles, etc. were found to perch freely on this grass. When the grass was cut and dried in shade it still emitted the odour. When this dried grass was spread in a corner of a building where mosquitoes were found to be numerous, it was noticed that a very large number of them perched on it during the daytime.

The Government Entomologist to whom some pots of this grass were given for conducting experiments on this, reported that mosquito larvae were found near the roots of this grass thus evincing no mosquito-repelling property assigned to it. The veterinary doctor to whom the grass was given for trial, reported that external application of aqueous extract of the grass did not give relief to the fowls infested with mites.

The following experiments were conducted under controlled conditions to test the mosquito-repelling properties:

Mosquitoes were reared in the laboratory and let into a cage in which this grass was also raised. In another cage mosquitoes were let in without the grass. The death rate of the mosquitoes was the same in both the cases.

Another experiment was conducted to ascertain whether the grass has any marked repellent effect. This was done by having two cages, connected by a tube. In one case *Melinis minutiflora* was growing but not in the other. Mosquitoes introduced into the first cage showed no marked tendency to migrate to the second cage and vice versa. Although a small number of mosquitoes moved across through the connecting tunnel, no evidence was obtained of any repellent effect.

The grass was macerated and distilled to obtain the principle responsible for the odour. The distillate retained the smell of the grass. Mosquito larvae were bred in this distillate. They grew up normally as in the control (drain water) and the adults emerged showing that the distillate had no effect on the life of the larvae.

Some of this grass seeds were also sent to the Malaria Officer, Kalpetta, Wynaad, who subsequently reported that the grass did not exhibit any mosquito-repelling property. Reports from the agricultural research stations to which seeds were sent for trial also showed the same result.—*Department of Agriculture, Madras.*

VEGETABLE VALUE OF OPEN LEAVES OF CABBAGE PLANTS

A NORMAL cabbage plant consists, at harvest time, of the 'head' into which the upper whitish and tender leaves fold themselves up, and the more mature and deep green leaves which remain open below the 'head'. The heads are the crop of real economic value, as they alone are used as vegetable for human consumption.

At present when extreme scarcity of vegetables stares us in the face, and 'grow more vegetable' campaigns are launched all over India, it will be of great interest and economic benefit to the country to realize that the open leaves of cabbage plants, which are equal in bulk to the heads themselves, and which are either fed to cattle or thrown away into manure pits, can be used as human food with advantage. In fact, the open green leaves are richer in nutritional value than the cabbage heads themselves.

It is found that 290 lb. of whole cabbage plants yielded 140 lb. of heads, 125 lb. open leaves and 25 lb. of unusable stem. The yield

of cabbage heads alone per acre is in the neighbourhood of 20,000 lb., and the fact that the open leaves are equal to the heads in bulk, indicates the huge loss sustained.

The investigations, an account of which is given below, were carried out at Baroda during the course of the State's campaign to grow more vegetables.

A sample of leaves of curly *Kale*, a vegetable plant of the cabbage family, received through the courtesy of Lt. Col. Hancock, Resident at Baroda, suggested that the open leaves of cabbage might also be used in the same way. Further enquiries brought out the fact that, in some parts of Kathiawar, open leaves of cabbages are being used as vegetables by the poorer classes of people. Both of these types of leaves are deep green and rather coarse when fully mature, and when cooked with salt and spices after chopping in the usual way, give products that are slightly pungent but very tasteful and indistinguishable from one another. A number of cabbage growers and others were indeed surprised at the palatability of the cooked cabbage leaves. These leaves were welcome even when cut into shreds and used raw in salads.

Table I shows that the open leaves of cabbage are more than three times as rich in mineral contents, and possess more than double the amount of fibre than the parts forming the heads, and the former, being more sun-beaten and greener, possibly contain a much higher vitamin value as well.

TABLE I

Analysis of open cabbage leaves and heads

	Open fully mature green leaves per cent	Head		
		Immature of greenish leaves forming the outer part	Core or the central part per cent	Remarks
	1	2	3	4
Moisture	81·49	88·39	85·99	Average of three samples in each case
Dry matter	18·51	11·61	14·01	
Fibre	2·56	1·14	1·43	
Ash (mineral contents)	3·50	0·86	1·08	

It is, therefore, clear that the nutritional and vegetable value of the open, greener leaves of cabbage plants is much higher than that of the heads, which are actually eaten. If only the former could be brought into common use as human food, whether in the fresh or dehydrated forms, our vegetable supply will greatly increase without extra cost or trouble.—*S. S. Bhat, Horticulturist to Government, Baroda.*

PENICILLIN ICE CREAM

A NEW method of mixing the miracle drug penicillin with ice cream for highly effective administration by mouth instead of the usual hypodermic injections, was announced recently by the United States Navy—a fact that not only made news as far as the daily press of the country was concerned, but also opens some brand new merchandizing possibilities for the ice cream industry of the nation.

This new method of mixing penicillin with ice cream was developed by the Naval Training Centre Sanitation and Preventive Medicine staff at San Diego, California, after seven months of research, according to *The Hoist.*

'Careful scientific research', relates *The Hoist*, 'has proved the efficacy of the treatment in combating streptococcus infections of the throat, scarlet fever, trench mouth, gingivitis, stomatitis and acute or sub-acute tonsilitis.

'When experimentation first started, one of the greatest problems to overcome was the fact that penicillin, in its pure state is extraordinarily bitter, tasting like quinine. Ice cream proved, after numerous tests, to be the ideal carrier of base for the medication. It was found to meet the taste requirements and to dissolve slowly, clinging tenaciously to the mucous membranes. Another factor in selecting ice cream was the fact that penicillin retains its potency for a considerable period when kept in a chilled environment.

'Particularly good results were obtained in the treatment of babies by this method. Not only does it eliminate the objectionable needle injections, but, in infants who have difficulty in swallowing, penicillin ice cream is readily acceptable and brings relief promptly.

'Value of the new treatment is enhanced by the fact that in the case of throat infections ice cream is usually the most acceptable food. Thus patients receive the nutritional value of ice cream and their medication at the same time'.

In the preparation of the medication, reports *The Hoist*, ordinary ice cream is allowed to become soft and then the penicillin is added.

After being thoroughly mixed, the ice cream and penicillin mixture is poured into paper cups and refrozen. The unit dose, when given by mouth, varies from 2,000 to 25,000 units of penicillin, depending upon the severity of the case. Severe cases are treated every four hours around the clock.

Even in severe cases, 10 doses of the penicillin ice cream usually results in complete elimination of streptococcus infections, it is claimed. 'After the second cup of ice cream, patients were found to be comfortable and the throat irritation relieved'.—*Canadian Dairy and Ice Cream Journal*, November 1945.

MILK—THE STAFF OF LIFE

THERE is an old adage that 'bread is the staff of life'. But this will need revising if people will only realize that 'Milk is nature's most nearly perfect food'. And it seems to be 'up to' the producers and processors of milk and milk products to drive this fact home to the consuming public. Nutrition experts at the University of Wisconsin have handed out these 10 reasons why milk has earned this title:

One quart of milk gives 45 per cent of your daily protein need;
One quart of milk gives 20 per cent of your daily calorie need;
One quart of milk gives 66 per cent of your daily phosphorus need;
One quart of milk gives 33 per cent of your daily fat need;
One quart of milk gives 145 per cent of your daily calcium need;
One quart of milk gives 33 per cent of your daily Vitamin A need;
One quart of milk gives 14 per cent of your daily Vitamin B need;
One quart of milk gives 100 per cent of your daily riboflavin need;
One quart of milk gives 50 per cent of your daily Vitamin C need;
One quart of milk gives 20 per cent of your daily Niacin need.

Milk is the only human food which if mineralized with iron copper and manganese gives it all the requirements of a complete food.—*Canadian Dairy and Ice Cream Journal*, November, 1945.

COVER PICTURE

The illustration on the cover represents a country seed drill used in wheat cultivation— (*Courtesy of Central Publicity Officer, Indian State Railways*)

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THE PROBLEM OF *KANS*

THERE are many factors which affect agricultural production adversely and are thus in direct conflict with the interest of the farmer. One of these is the infestation of arable lands with weeds. Weeds cause damage to the crops sown in various ways and thus bring about a poor return to the farmer. Weeds exhaust the soil of its nutritive components and moisture, which would otherwise sustain cultivated plants and thus effect a considerable reduction in yield and quality; in extreme cases of heavy infestation cropping ceases to be an economic proposition.

Kans grass (*Saccharum spontaneum*) is one of the most pernicious weeds in this country. This weed is widely distributed in all parts of India, specially in the plains, and particularly in the Central Provinces, Malwa plateau and in the Terai Zone of the United Provinces. The degree of infestation may be judged from the fact that in extreme cases, there is no other alternative left but to give up cultivation of the particular land. Howard and Howard[1], aptly sum up the situation thus: 'At the moment over a larger portion of the chief cotton tract of India, *kans* is king and the cultivator is his subject'. The monetary loss for which this particular weed is responsible has not been computed but 'at a conservative estimate the reduction in the yield of cotton caused by this weed is at least a third of the crop[2]'.

Kans belongs to the large family of grasses, and, as the botanical name implies, is allied to sugarcane. It has erect, tall and thick shoots and grows into a dense bushy cover on the land it infests. The underground stems, technically known as rhizomes, and roots are deeply laid inside the soil about eight or nine inches below the surface and form a sort of underground network holding the soil securely in the meshes. The plant multiplies mainly by means of its rhizomes, which also serve as a storehouse of food materials for the plant, but propagation by seed probably also plays an effective part. The rhizomes are useful organs which, in addition to the reproductive functions, are particularly helpful when the parts above the ground are exposed to unfavourable conditions.

Both rich and poor types of soil lend themselves to the growth of the weed but, as is to be expected, growth is more luxuriant and infestation particularly heavy on rich soil.

As to the mode of its first appearance on fields, previously uninfested, nothing seems to be definitely known. It is quite probable that the seeds of the crops to be sown are contaminated with the seeds of *kans*. And therefore at the time of sowing, *kans* seeds, together with those of the crops, are introduced unawares into the field. Or, when a plot of land is left altogether unattended, the seeds may be carried to it by wind and rain. The most favourable period of growth seems to be during the monsoon months. The chief effects on the soil are that the weed exhausts the soil of most of its nitrogen content and sucks up water even from the deeper layers with the help of its penetrating root system. Because of the progressive depletion of soil nutrients, it is no wonder that *kans* dies off by itself if the land is allowed to lie fallow for a prolonged period[3].

[1] Howard, A. and Howard G. L. C. (1929). *The application of Science to crop-production*, Cambridge University Press.

[2] Howard, A. (1927). *Agricultural Journal of India*, **12**, 39

[3] Prasad, A. (1912). *Agricultural Journal of India*, **1**, 208

From what has been said above it is apparent that in order to counteract one of the major factors diminishing agricultural production, this weed must be controlled or, preferably, eradicated. Various methods have been proposed from time to time for dealing with this weed ; these may be grouped under three heads : (1) mechanical, (2) biological and (3) chemical. It will be profitable to examine the methods proposed separately.

The mechanical methods may be taken up first for consideration. Ploughing is one of the methods advocated and, to a certain extent, success seems to have been achieved. The underlying idea appears to be that by ploughing, the underground parts of the weed, i.e. rhizomes, would become detached, exposed and would ultimately be desiccated and killed by the sun. Since the plant has rhizomes and roots well below the surface soil, ploughing has to be necessarily deep enough to effect their exposure. The use of tractors for this purpose, although highly desirable, is precluded because of the expenditure involved. 'An adjustable *bakhar*' according to Howard[4] capable of working to the depth of 8 to 9 inches 'can be usefully employed for this purpose'. 'The broad share of this plough, when the wings and sole are removed, acts as a very efficient and self-clearing *bakhar* blade and uproots the dense mass of *kans* rhizomes'. Ploughing and cross-ploughing are recommended in the beginning of and during the rainy season or towards the approach of winter which synchronizes with active growth-period of the weed. Even after these operations, pieces of rhizomes, which remain alive, may put forth fresh shoots ; these have to be dug out and destroyed. This method has the advantage that the 'soil is lifted, not inverted, and no interference with levels takes place'. The cost of the implements required is not prohibitive and a *kans*-infested field can be reclaimed within a year.

It has, however, been pointed out that the method detailed by Howard serves at best only to control the weed and not necessarily to eradicate it. The isolated shoots, appearing after the completion of ploughing operations, have to be attended to and this adds to the total cost of eradication. Further, pieces of rhizome escaping injury and desiccation are potential sources of re-infestation.

The Department of Agriculture of the Central Provinces and Berar[5] recommends the adoption of the 'cultivated fallow system' for the eradication of the *kans* weed. The land is ploughed several times a year but no crops are grown. The implement used is a *desi* plough. By continuous ploughing and cross-ploughing the grip of roots on the soil is relaxed ; the underground parts are also exposed thereby. It has been suggested that eradication is effected by this method to an appreciable extent in about a year's time. The use of *desi* plough, as proposed in this method, is no doubt an attractive feature from the point of view of ordinary farmer who can ill-afford costlier implements. But leaving the land fallow for the whole year prevents the farmer from getting any returns from it and ultimately adds to the expenditure incurred in the eradication of the weed. Moreover, scattered bits of rhizome escaping injury and remaining unattended to for a long time, may lead to resumed growth and possible re-infestation.

Another method has been tried at the Izatnagar Farm of the Imperial Veterinary Research Institute and has been reported by Hosain[6]. The method essentially consists of cultivating the land with a 'Victory' plough, and at the same time, picking out the exposed underground parts from the furrows. The operations are carried out after the *rabi* crop has been harvested and, previous to ploughing, the land is softened by irrigation. Sunn hemp is then cultivated; after the plants have attained a certain height, they are cut down and allowed to decompose on the field. This prevents any fresh growth of isolated rhizomes. This method is somewhat different from the foregoing ones in that it makes use of biological means of control together with purely mechanical devices.

All the mechanical methods described above suffer from obvious defects either in the shape of special implements or employment of extra labour, thus increasing considerably the cost involved. Further, it is doubtful whether by mere exposure the underground parts are completely killed. On the other hand it appears conceivable that some isolated portions may retain the capacity of initiating fresh growth and these may possibly help in the re-infestation of the treated land afresh.

[4] Howard, A. (1927). *Agricultural Journal of India*, **12**, 39

[5] *Eradication of kans by the cultivated fallow system.* Leaflet No. 16 of 1937, Department of Agriculture, C. P. and Berar

[6] Hosain, M. F. (1944). *Indian Farming*, **5**, 128

With regard to the biological control methods it has been held that these are more effective and that eradication is more complete. Tambe and Wad[7] suggested that the weed could be exterminated simply by providing adequate cover to the land infested by it. They found that *Crotalaria juncea* (sunn hemp) could be successfully employed for this purpose. The plants are grown to a certain height; they are then cut down together with the weed, spread over as a sort of cover on the land infested and allowed to decay there. Any other material could be used as a cover; *bhoosa*, for example, or even a collection of the weed itself could be used for this purpose. A heavy layer of manure would serve as well or bunding the land and filling it with water,[8, 9] but in the case of such treatments the cost would be prohibitive.

The method outlined above, besides being simple, has several additional points in its favour. It does not require any special appliances and involves no extraordinary expenditure or unusual employment of labour. It has the additional advantages that the time required is rather short, that the land is enriched by the decomposed covering matter and that more or less complete eradication can be effected.

The control of the weed by means of chemical substances remains to be considered. A variety of chemicals have been employed for weed killing or weed eradication in foreign countries. These have been used in various ways. For example the soil may be rendered unsuitable for particular types of weed by altering its acidity by the application of certain chemicals. In other cases the weed may be scorched by the chemicals employed or be killed as a result of the toxic or poisonous effects induced by these.

Very little work seems to have been done in India on the control or eradication of weeds by chemical substances. Tambe and Wad[10] write that 'chemicals such as sodium chlorate, sodium arsenite and sulphuric acid have recently been employed for weed eradication but trials with these chemicals on *kans* have not given satisfactory results and their application was laborious and costly'.

From the above brief review it would be clear that the various methods employed for the eradication of *kans* have been tried far too exclusively of each other. It has not been generally realized that the results obtained from one method may be helpful or even complimentary to those from another. Thus a combination of several methods may prove more fruitful than the employment of any one singly. The results obtained at the Izatnagar Farm encourages such a belief.

Plant hormones have recently been successfully used for killing weeds[11]. A number of chemical equivalents of actual hormones have been discovered which, while adversely affecting the development of weeds, leave many cultivated crops unaffected. One such compound, named Methoxone (4-Chloro-2-methylphenoxyacetic acid), has been found to be amazingly successful in killing weeds. It has been observed that it would kill various weeds without causing any damage to the cereal crop grown when applied, either in solution or as powder, at the rate of eight ounces per acre. The discovery that hormone preparations may be used for fighting weeds opens up fresh avenues for attacking a baffling enemy. How far the application of this discovery may be helpful in this country remains to be seen.

[7] Tambe, G. C. and Wad, Y. D. (1938). *Agriculture and Livestock in India*, **8**, 397

[8] *Eradication of kans by the cultivated fallow system.* Leaflet No. 16 of 1937, Department of Agriculture, C.P. and Berar

[9] *The eradication of kans, kunda, Dub and Nagarmotha* Leaflet No. 17 of 1937, Department of Agriculture, C.P. and Berar

[10] Tambe, G. C. and Wad, Y. D. (1938). *Agriculture and Livestock in India*, **8**, 397

[11] *Discovery* (1945). **6**, 327

Original Articles

PLANNING YOUR HOME GARDEN. II

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If plantation of ornamental trees in the compounds of private houses is properly planned, their cumulative effect will be very striking and thus private individuals can create an artistic environment for their families and also add to the beauty of the town which has claims on them as its citizens. Unfortunately ornamental trees find a very unimportant place in our house-building schemes. Few people realize that ugly-knotted *Neem* trees, dark mango and *Siris* trees with noisy rattling pods produce a very ugly effect and mar the beauty of even the most modern-looking building. Compounds of houses with crowded growth of mangoes, guavas and jack-fruits look gloomy, dark, depressing and dismal.

Compounds of private houses

When you are building a new house, the first step you should take is to cut all existing *Siris, Mahua, Babul* and other trees, most of which are self-grown. This may appear painful especially when mature trees are concerned, but it is a necessity, for no planning is possible unless the existing confusion is cleared. In any case if shade is a problem, the existing self-grown trees should be gradually removed. After this preliminary surgery is over, start the new plantation. The best plan for a house of average size on a plot from two acres and less is as follows: Have ornamental flowering trees of medium size at the sides, dwarf ornamental trees or shrubs in front, and

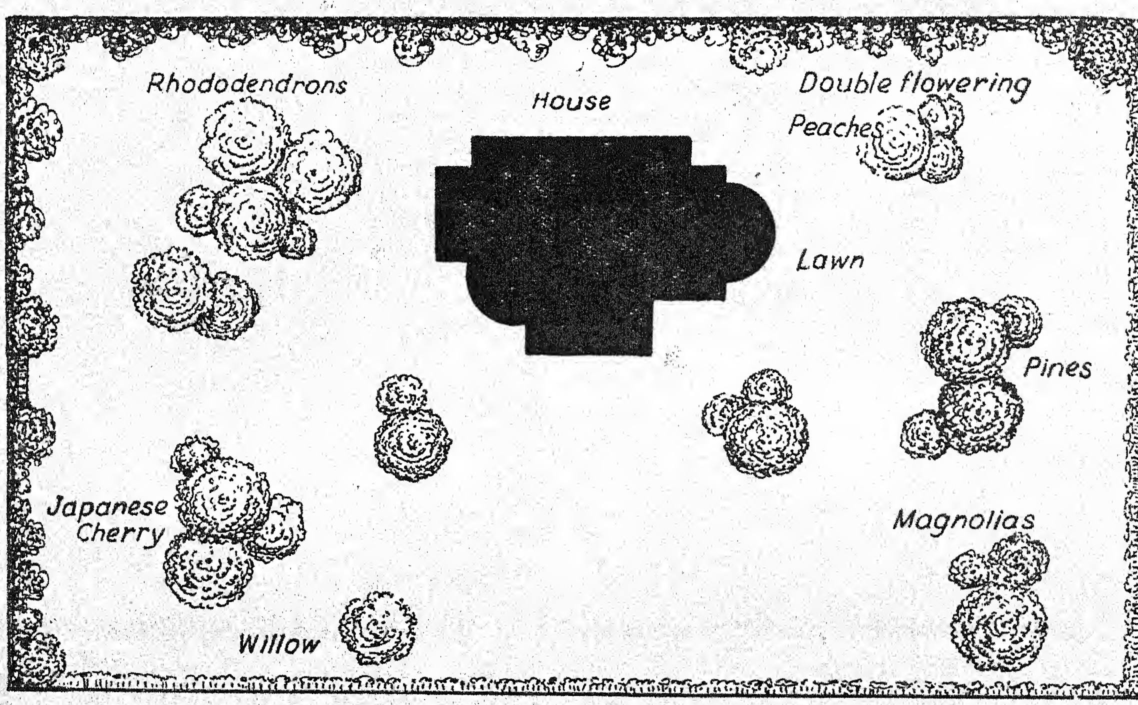

Fig. 1. An Informal Plantation Scheme for a house on uneven land

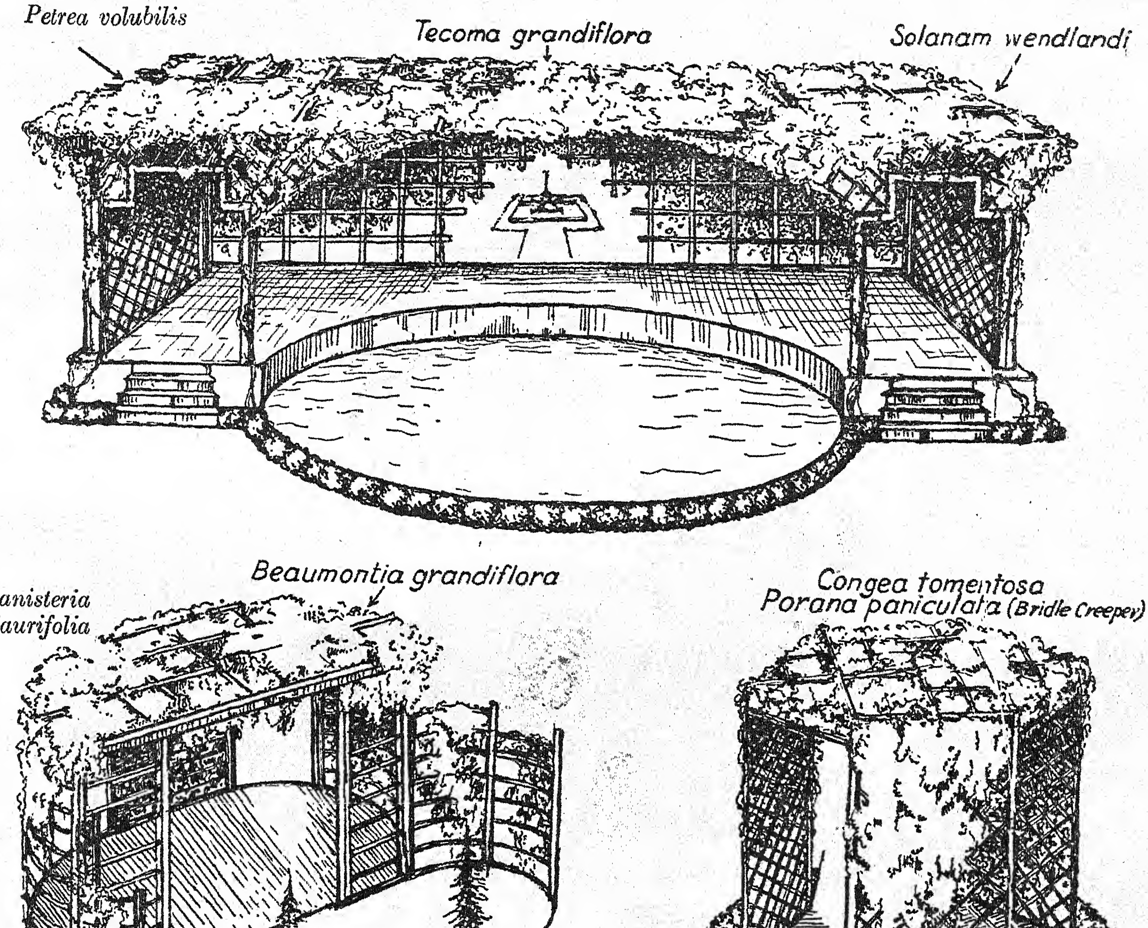

FIG. 2. Different types of Pergolas with suitable creepers

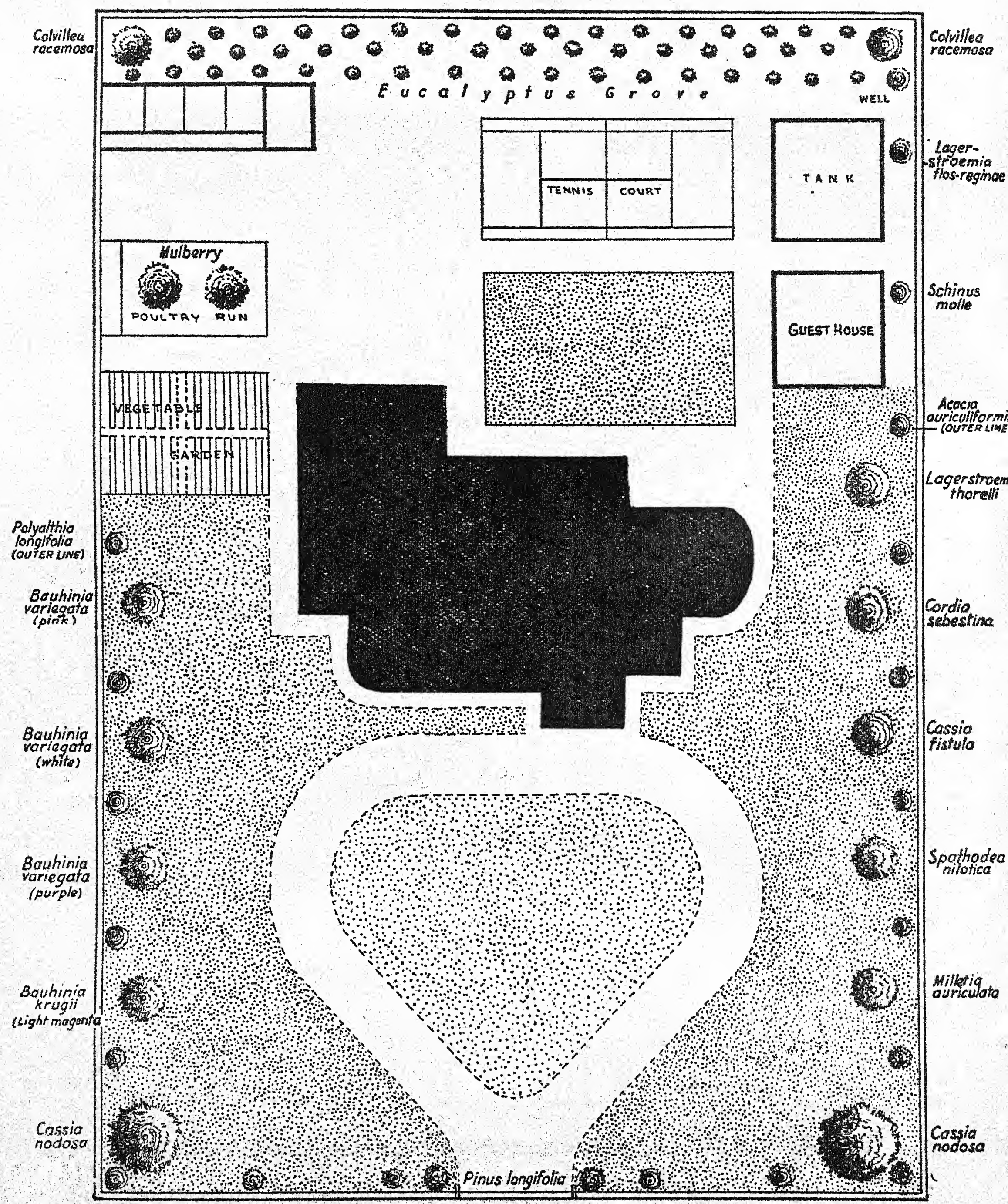

FIG. 3. A Formal Plantation Scheme for a double-storied house in a plot two acres in area

fruit trees at the back behind the house where they are not visible from the main entrance.

In the case of small and medium-sized houses with small compounds, ornamental trees should be planted *only on the outer* boundaries. It is no use planting avenues on the inner roads in a small compound, for such avenues produce a stifling effect and the compound appears narrower still. If you have about two acres of land then have a double row of trees at the sides; the outer row should be of ever-green shade trees with ornamental foliage, like *Acacia auriculiformis*, *Polyalthia longifolia* (*Asokan*), *Putranjiva roxburghii*, or *Amla* (*Phyllanthus emblica*). Have a row of one species on one side and of another on the other. All these trees have a compact linear crown and beautiful foliage. Planted at a distance of 15 ft. they produce a beautiful screen which also serves as a background for the flowers of ornamental flowering trees which should be put in the second inner row at a distance of about eight feet from the outer row (Fig. 3). Only dwarf flowering trees which are listed separately should be grown, for it is no use putting big trees with spreading umbrella-like crowns like *Gul Mohurs* in compounds of small houses where space is not available for their full growth.

Trees with fragrant flowers

We have also a number of trees and shrubs which emit fragrance at night time, especially during rains, such as *Gardenia lucida*, *G. florida*, *G. latifolia* and *Cestrum nocturnum* (*Raat ki rani*). These can be planted to their best advantage opposite windows and doors of bedrooms, so that you may enjoy their fragrant smell in the evenings, particularly in summer months.

Planning the garden in your compound

While planning your ideal home, do not forget to pay a proportionate attention to the layout of your compound. The house and the garden in the compound should be designed as a unit, and one should consider how the garden will look from the house, and how the house will appear from the garden. The garden of the compound provides a background and setting to the house, as a frame to a picture. The view of the garden from the house is very important and there should be something pleasant and colourful to look at from every door, window and verandah. Facing the verandah beyond the open lawn, one may plant Pink Cassia, *Amaltas*, Peltophorum, Jacarandas, or Bauhinias which all flower from March to June, the hot months in which we sit in the verandahs of our houses. However, do not smother the house in trees. The trees should be restricted to the boundary wall and corners of the plot, and have a level, quiet and restful lawn in front of the house (Fig. 4). In a small plot, a feeling of spaciousness is given by a foreground of lawn, and if trees are planted too near the house, the result is stifling confusion and narrowing of the compound.

As regards the design for your garden, the only sound advice for a person building a modern house is to choose a simple design harmonizing with the plain modern architecture of the house. Intricate flower-beds with borders, unnecessary hedges, meaningless paths, useless pergolas, sun-dials, fountains, statues, and unnecessary green-houses should be avoided. Star-shaped and polygonal flower-beds are difficult and more costly to maintain as compared with simple rectangular, round or oval plots and appear irritating. Simple circular, oval, or rectangular plots are not only easier to maintain, but are also restful. If there is a low piece of land, make use of it by making slopes and terraces for the growth of annuals. Annuals grown on 4 to 5 terraced plots give a fine display. The flower-beds should be at least 6 to 10 ft. broad, for the annual herbaceous border with tall annuals at the back, medium-sized plants in the middle and dwarf annuals in front cannot be displayed to its best effect in narrow strips of land.

So far verandahs are concerned it is better to keep them free of crotons, ferns and such other plants. Too many flower-pots in verandahs, the relic of early Anglo-Indian gardening, create untidiness and are also favourite haunts of snakes, scorpions and spiders. Fern-houses also go ill with modern houses. On the other hand cacti with their peculiar globular, cylindrical and snake-like shapes fit in admirably with modern architecture and a rock-garden with an assorted collection of cacti is an asset to a modern house. Lantanas, *Hazara* orange, Petraea and Bougainvilleas grown in standards also add a good deal of charm to a compound. Do not have too many of these, a few plants judiciously placed at appropriate places produce a far more pleasing effect than a crowded group of plants. Simplicity of treatment and design is the key-note of a modern garden.

Hedges

Hedges form an important component of a garden in the compound of a house. Here too one must discard formalism. Place a hedge where it is necessary and where it has some function to serve. Hedges can be used for separating the kitchen garden from the annual flower garden or for screening a portion of the garden where one can recline in comfort in the sun during winter. A variety of Cypress (*Thuja*) or *Mor Pankhi* forms an excellent hedge and on account of its ever-green nature and dark-green colour is to be preferred to common Dodoneas and Durantas. Hedges can also be used not only for marking the boundaries of the compound, but also for screening servants' quarters, garages and other unsightly features of the house.

Where the land available is small, do not have the building in the centre. This will mean creation of useless ribbons of land on both sides which cannot be of any value. In a small plot, place the building on one side thus leaving a fairly ample space for a lawn in front and on one side in the shape of an L, the sides of which can be planted with dwarf ornamental trees. In the plantation of trees one should also overcome the craving for symmetry by putting exactly similar trees on both sides. In the art of decoration balancing effect is more desirable than dead geometrical symmetry. Two groups of trees of two different sizes on both sides create an artistic balancing effect. In modern decoration the tendency is to break the symmetry in such a way that balance results.

There are some people who would rather have plants which produce flowers all the year round, rather than annuals which flower for a couple of months only. Where space is limited there is much to be said in favour of this view. Canna-beds, ornamental shrubs like *Myenia erecta*, red, yellow and orange varieties of Ixora, blue Plumbago and *Zinnia linearis*, a perennial dwarf Zinnia with orange-coloured flowers, provide a good substitute for annual flowers. Canna-beds can be laid out opposite bathrooms, as their broad leaves have a quick rate of transpiration and provide an easy solution of the drainage problem.

Vegetable gardening has its artistic side as well. Neat rows of cauliflowers, egg-shaped white brinjals and scarlet tomatoes look attractive. Bottle-gourds and Snake-gourds when grown over a scaffolding of tree-trunks supporting a roof of twigs appear very charming in the month of November. Beans, *Pethas* and pumpkins may also be grown on such supports where they are safe from monkeys and other pests.

List of dwarf ornamental trees suitable for small compounds–

I. Flowering trees

1. *Acacia auriculiformis*
2. *Alangium Lamarckii*
3. *Bauhinia purpurea*
4. *B. variegata*
5. *Brownea coccinea*
6. *B. ariza*
7. *Butea frondosa*
8. *Cassia fistula*
9. *C. Javanica*
10. *C. marginata*
11. *Cochlospermum gossypium*
12. *Cordia sebestina*
13. *Crataeva religiosa*
14. *Erythrina blackeii*, *E. crista-galli*
15. *Guaiacum officinale*
16. *Giliricidia maculata*
17. *Holarrhaena antidyssenterica*
18. *Jacaranda mimosaefolia*
19. *Kleinhovia hospita*
20. *Lagerstroemia thorelli*
21. *Mesua ferrea*
22. *Milletia auriculata* and other species
23. *Pongamia glabra*
24. *Plumeria rubra and P. alba.*
25. *Saraca indica*
26. *Solanum wrightii*
27. *Spathodea nilotica*
28. *Sterculia colorata*
29. *Tecomella undulata*
30. *Thespesia populnea*

II. Fragrant trees and shrubs

1. *Alstonia scholaris*
2. *Anthocephalus indicus*
3. *Artabotrys odoratissimus* (*hara champa*)
4. *Gardenia lucida*
5. *G. latifolia*
6. *G. florida* (*Gandhraja*)
7. *Hiptage madablota*
8. *Ixora parviflora*
9. *Lawsonia alba.*
10. *Magnolia grandiflora*
11. *Michelia champaca*
12. *Murraya exotica*
13. *Nyctanthes arbortristis*
14. *Schinus molle*

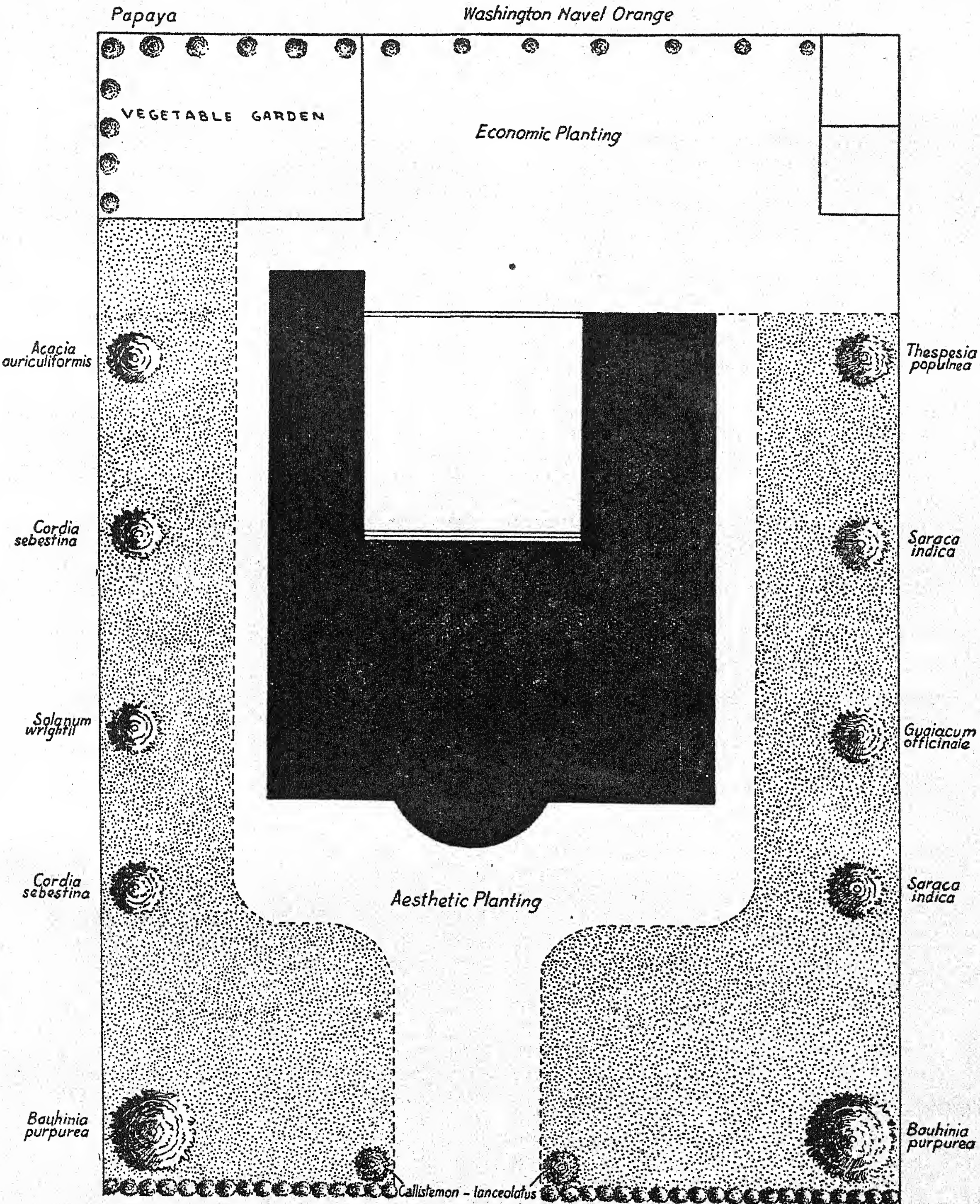

FIG. 4. A Scheme of Evergreen Flowering Trees for a small house

III. Trees with ornamental foliage only

1. *Averrhoa carambola*
2. *Callistemon lanceolatus*
3. *Citharexylum subserratum* (fiddle-wood)
4. *Polyalthia longifolia*

IV. Trees with ornamental fruit

1. *Hazara* orange

Fruit trees in compounds of houses

We do not recommend the total banishing of fruit trees from the compounds of private houses. From the aesthetic point of view, the main objection is that on account of their unattractive appearance fruit trees should on no account be grown in the front part of the compound of the house. They should be relegated to the back part of the compound behind the house where they are not visible from the entrance. The governing principle should be 'aesthetic planting in the fore-ground and economic planting in the back-yard of the house'. (Fig. 4). Economic planting should be unobstrusive enough to escape notice and should attract the least attention.

Another nuisance which results from the plantation of mangoes and guavas is that of flying foxes and parrots. While the flying foxes produce eerie noises at night time, the parrots play havoc with the fruit during day time. As Mr M. D. Chaturvedi observes 'On no account, should a residential compound be permitted to degenerate into a fruit garden with the necessary accompaniment of contractors, *malis* and beating of kerosene tins and other weird noises devised to scare away birds and animals.'

Even for the background one should be careful in the selection of fruit trees. Citrus plants like, grape-fruit, oranges, sweet-lime (*Meetha Nimboo*), and lemons are particularly desirable on account of the sweet smell of their flowers and their fruit which is rich in vitamin content and is a welcome addition to the table. *Carissa carandas* has scented flowers and the fruits are ornamental and useful for pickling. Other trees which may be planted are figs (Black Ischia and Black Turkey), dwarf grafted mango varieties like *Dassehri*, *Sufeda* and *Benarsi Langra*, Papaya (*Papeeta*), *Bel* (*Aegle marmelos*), and grafted *Amla* (*Phyllanthus emblica*). Papayas contain pepsin, an enzyme which digests proteins and are very helpful for meat-eaters. Fruit of *Amla* contains a very high percentage of vitamin C. Figs are laxative and are beneficial for dyspeptics.

Compounds of big houses

Where a big area is available, say four to five acres, one can make use of tall trees like Eucalyptus, trees with spreading crowns like *Gul Mohurs* and Pink Cassia (*Cassia nodosa*). In such compounds one can also have avenues along the inner roads. For the avenues, trees with long linear symmetrical crowns are suitable for they appear graceful when grown in a line and also do not obscure the view of the house.

An avenue of *Polyalthia pendula* appears very attractive along an ascending road. There is a beautiful avenue of this pendulous variety of *Asokan* in the 'Kamla Retreat', house of Sir Padampat Singhania at Cawnpore. Other trees suitable for avenues of approach roads are *Polyalthia longifolia*, *Acacia auriculiformis*, *Callistemon lanceolatus* (Bottle-brush), *Eucalyptus*, *Sterculia alata*, and *Averrhoa carambola* (*Kamrak*).

Only trees with a regular and shapely crown and preferably those with pyramidal, linear or spire-like tapering crowns are suitable for planting in the form of avenues. Other requisites are a straight stem, preferably tall, and rich evergreen foliage. In big compounds with long drives, avenues are desirable. However, restrict your choice to one species only, as the beauty of an avenue lies in the uniformity of the crowns of trees and their growth. There are some trees like the Royal Palm, (*Oreodoxa regia*) which appear attractive when grown in the form of avenues in public parks only in compounds of houses they appear unsuitable. They impose a mechanical regularity on an avenue which may appear attractive along a broad public road, but is jarring in the compound of a house.

Three to four rows of Eucalyptus trees grown at the back of a big house, provide a grand background. Eucalyptus is a gregarious tree which looks attractive only when grown in a clump. A single row of Eucalyptus at the sides looks ugly as well as awkward. So if you decide to have Eucalyptus at the back, plant three to four alternating rows close together. Colvilleas which also grow very tall, look very majestic when grown at the corners in the back row.

A big compound also provides scope for growth of dwarf ornamental flowering trees in clumps and in alternating rows. Even if big

trees are grown, overcrowding should be avoided and the temptation of planting too many trees should be resisted. Better confine your choice to a few select trees rather than aiming at the creation of a botanical garden.

Asokan (*Polyalthia longifolia*) can be effectively used for screening off the compound of a big house from a public road. The *Asokan* avenue along the compound wall of the Government House at Lucknow is an admirable example of this type, and a thick close-growing row of *Asokan* forms a tall hedge not only ensuring privacy but also acting as a filter for dust.

While symmetrical placing of trees may not be desirable in a small compound, it is all but necessary in a big compound with a building of a large size. Such a building should be placed in the centre of the plot. In front one may have a circular or semi-circular lawn as the space permits fringed by a road. In the centre of the lawn one may plant a solitary tree with a spreading crown like *Gul Mohur*, or Pink Cassia. If one's predilection is towards water plants, one may place a pool in the centre with red lotuses, and white and blue-purple lilies. Small larvicidal fishes can also be reared in such pools to keep them clear of mosquitoes. The amazing assortment of white, and blue-purple lilies, which Rai Bajrang Bahadur Singh, the Taluqdar of Bhaduri in Partabgarh district in the United Provinces has been able to collect, is a good illustration of the beauties of aquatic gardening which can be enjoyed by the owners of big houses and large compounds with irrigation facilities. Even if a pool for the culture of aquatic plants is not regarded as desirable, it is advantageous to have a small bathing pool at the back of the house, built sufficiently high with its waste water discharging into the lawn and the garden.

List of big ornamental trees suitable for big compounds only

I. Beautiful flowering trees

1. *Anthocephalus indicus*
2. *Bombax malabaricum*
3. *Cassia nodosa* and *C. grandis*
4. *Chorisia speciosa*
5. *Colvillea racemosa*
6. *Erythrina indica* and *E. suberosa*
7. *Lagerstoemia flos-reginae*
8. *Millingtonia hortensis*
9. *Peltophorum ferrugineum*
10. *Pithecolobium saman*
11. *Poinciana regia* (*Gul Mohur*)
12. *Sterculia colorata*

II. Fragrant trees

1. *Dillenia indica* (*Chalta*)
2. *Mimusops elengi* (*Moulsari*)
3. *Pterospormum acerifolium* (*Kanak Champa*)

III. Trees with ornamental foliage

1. *Eucalyptus* (all species)
2. *Phyllanthus emblica* (*Amla*)
3. *Putranjiva roxburghii*
4. *Terminalia arjuna*

IV. Shade trees

1. *Diospyros embryopteris*
2. *Ficus retusa*
3. *F. Infectoria* and other species
4. *Kigelia pinnata*
5. *Tamarindus indica*

VIRUS DISEASES OF POTATOES IN INDIA

MASKING OF MOSAIC SYMPTOMS AND YIELD IN RELATION TO MOSAIC

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IN an experimental plot in the Mycological area of this Institute on the study of incidence of virus diseases of potatoes during the spring of 1941, it was observed that mosaic incidence varied from week to week and at times suddenly a marked reduction in apparent mosaic incidence was recorded. Such a fall in the incidence was very misleading when the disease incidence in a particular field was recorded only once or even twice during the growth of the crop. It was therefore considered necessary to investigate this aspect in detail with a view to obtaining correct information regarding the examination of the field crop for mosaic incidence. During the course of this investigation observations were also made on the effect of different grades of mosaic disease on yield. These observations will serve as a guide for the uniformity of grading of degenerative conditions in plants for the certification of fields reserved for seed purposes.

Potato varieties studied

During the experimental work, potato varieties *Phulwa* and *Darjeeling Red Round* supplied by the Imperial Economic Botanist were mainly used. In addition, observations on a variety with white round tubers obtained from *Darjeeling*, *Red Round* from Darjeeling and some foreign varieties obtained from the Vegetable Specialist, Lyallpur, Punjab, were also made.

Well-sprouted apparently sound tubers of almost uniform size and shape were in every case planted on ridges two feet apart, the distance from tuber to tuber being one foot. Examination of the plants for mosaic incidence was begun as soon as the plants were about four to six inches high. At regular intervals throughout the growing period of the crop the disease symptoms in each plant were recorded.

It was observed that while certain plants exhibited particular disease symptoms throughout the growing period, there were others which having for a period shown symptoms, later appeared healthy. It was obvious, therefore, that the disease symptoms in such plants had become masked. There were cases, however, where a particular plant showed disease symptoms and appeared healthy intermittently during the growing period.

For observation purposes, classification of mosaic disease into five arbitrary grades, as recognized by the Scottish Ministry of Agriculture[1], was adopted. The description of these mosaic types, as observed on potato plants of *Phulwa* variety, are noted below.

1. *Negligible Mottle:* In this type of mosaic, mottling is very slight and is in the form of small chlorotic spots on leaflets. It is generally visible on a close examination of the plant in shade but cannot be seen from a distance. The symptoms may not be visible at all on a sunny day unless shade is provided. As a rule, plants appear normal so far as the growth of different organs is concerned. The leaflets are not reduced in size and do not exhibit undulation of margins. The texture of the leaflets remains unaffected.

2. *Mild Mosaic*: Mottling is intense and can be seen on a sunny day from a distance of six to eight feet. Mottling takes the shape of large chlorotic areas on the leaf surface. The size of the plants is not affected. The plants on the whole are light green in colour. Rarely the leaflets show undulation of margins, purpling or slight distortion. The leaflets become slightly rough.

3. *Borderline Mild Mosaic:* As the name suggests, this type of mosaic is intermediate between *Negligible Mosaic* and *Mild Mosaic* as described above. If the plant is more conspicuously mottled it may be classed as a case of *Mild Mosaic* and if the plant is less obviously mottled it may be classed as a case of *Negligible Mosaic*. Plant and leaf-size remain unaffected. There is no leaf distortion and the texture of leaflets is not affected.

4. *Severe Mosaic:* The mottling in this grade of mosaic is extemely severe. Yellowish areas are visible all over the leaf surface except in the centre where a small green patch may

[1] Scott, R. J. (1938). *Mosaic diseases of the potato, Scot. J. agric.* 21, 121-132

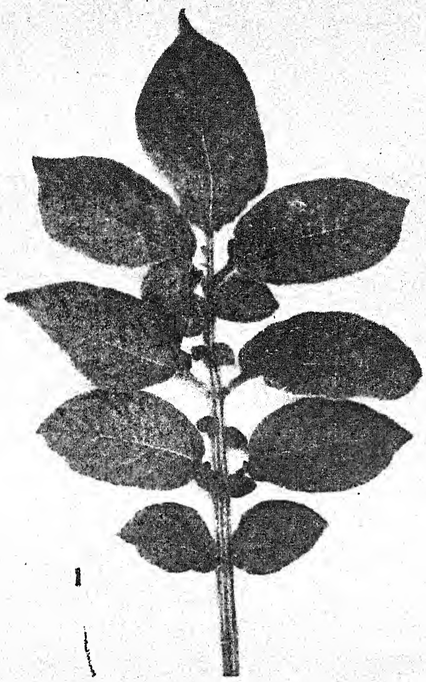


FIG. 1. Negligible Mottle

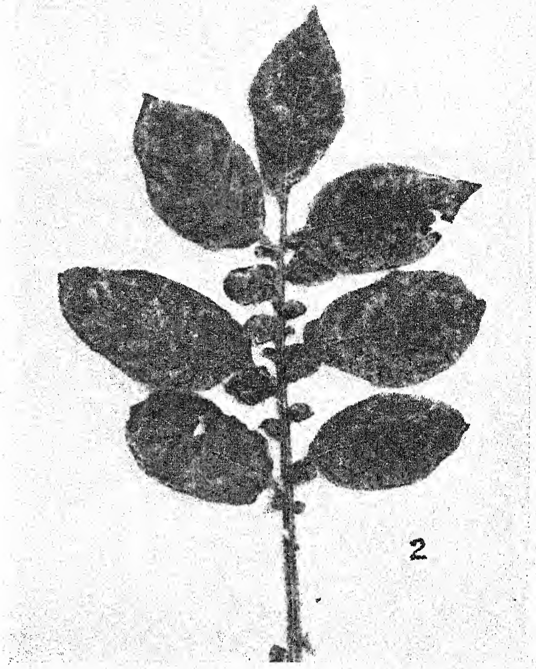


FIG. 2. Mild Mosaic

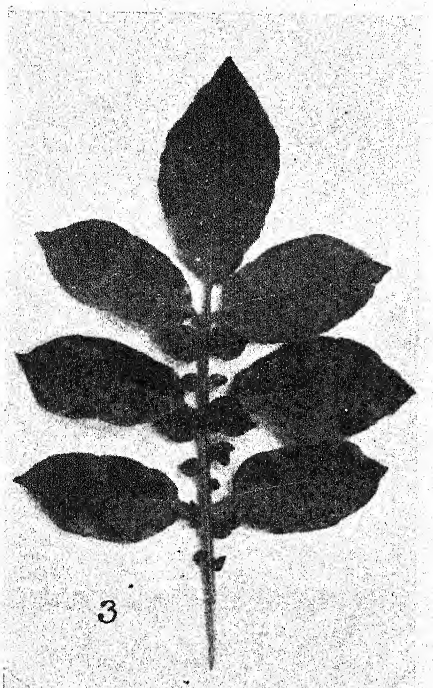


FIG. 3. Borderline Mosaic

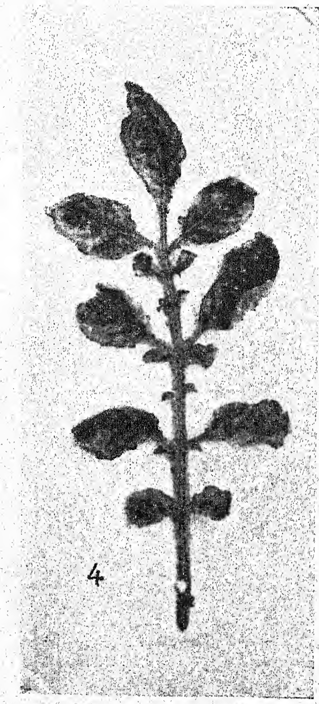


FIG. 4. Severe Mosaic

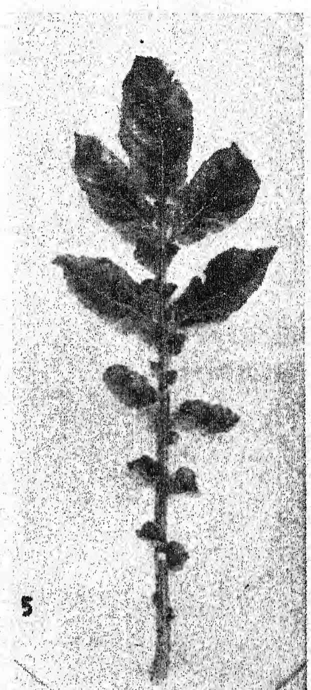


FIG. 5. Borderline Severe Mosaic

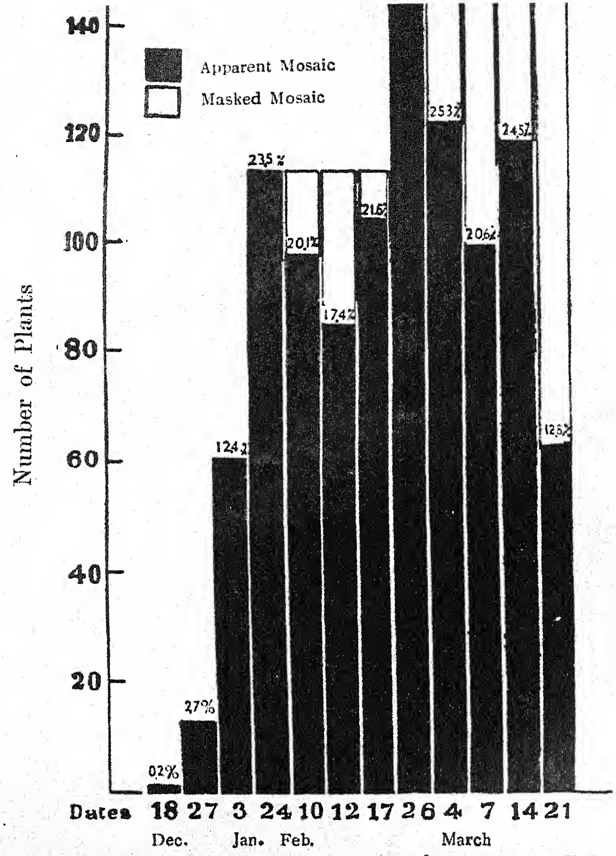
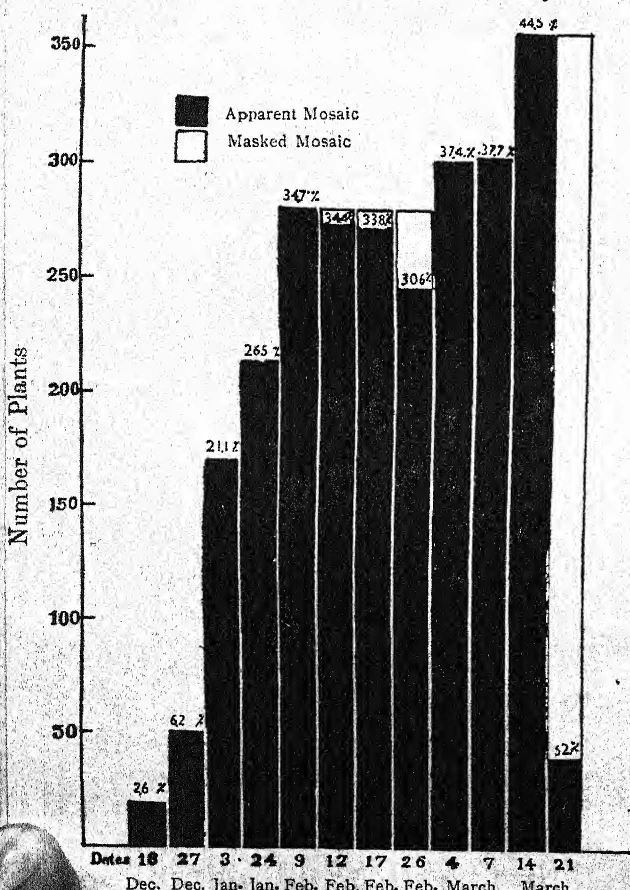
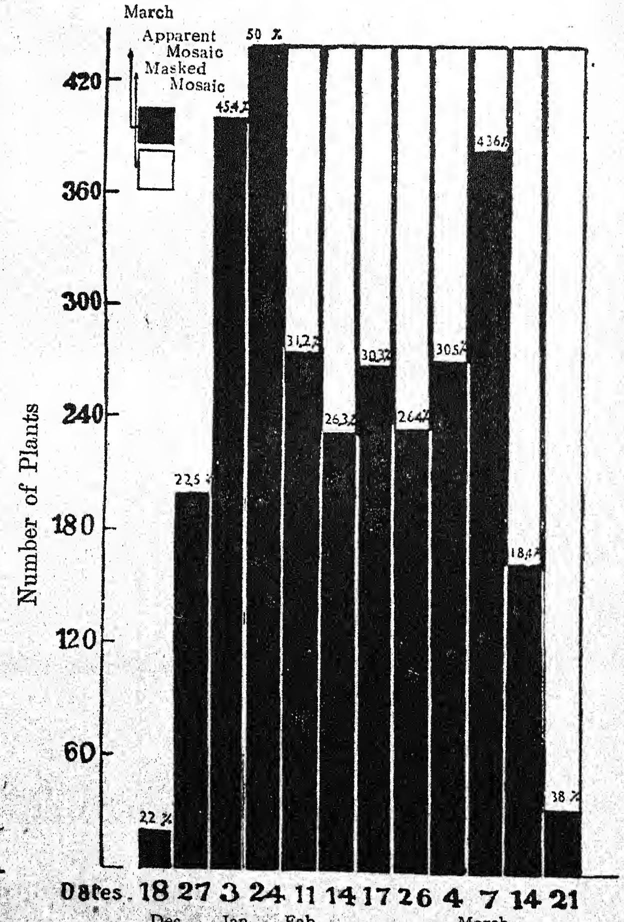


Fig. 1.
Masking of Mosaic Symptoms
Second Crop 1941-42
(Potato Var. Phulwa)





persist. Sometimes the whole leaf may turn yellowish. The plants are markedly dwarfed and may be only three to four inches high. The leaflets are greatly reduced in size, show distortion and puckering, and develop purplish margins. The general appearance of the foliage is extremely pale. Vein-bending is frequently observed and may at time be very prominent. The leaflets are wrinkled, thick, at times almost cup-shaped and brittle.

5. *Borderline Severe Mosaic:* This type of mosaic falls between *Mild Mosaic* amd *Severe Mosaic*. The leaflets are highly mottled, reduced in size, and distorted. The reduction in size of plants, however, is not so great as in the case of *Severe Mosaic*.

Incidence of the disease

Observations on mosaic incidence were made in both the plains crops at Delhi. In the plains of Northern India the first crop, i.e. the main crop, is planted in September-October and harvested in December-January. The second crop is sown in December-January and harvested in April-May.

Observations on the second potato crop: Potato varieties *Darjeeling Red Round*, *Phulwa* and *White Round* from Darjeeling were sown in three sub-plots and mosaic incidence was recorded frequently during the growth of the crops.

In the case of *Phulwa* variety, 0·2 per cent of the plants showed mosaic symptoms on 18 December, 1941. The maximum disease incidence of 30·1 per cent was observed on 26 February, 1942. The mosaic incidence between 24 January and 14 March, 1942, ranged between 17 and 30 per cent. The apparent disease incidence on 21 March, 1942, suddenly dropped to 12·8 per cent.

In *Darjeeling Red Round* 2·6 per cent of the plants exhibited mosaic symptoms on 18 December, 1941, after which date there was a gradual rise in mosaic incidence upto 14 March, 1942, when a maximum incidence of 44·5 per cent was registered. On 21 March, 1942, there was a sudden drop and only 5·2 per cent of the plants showed any symptoms of mosaic.

Plants raised from *White Round* tubers showed high mosaic incidence, i.e. 45, 50 and 44 per cent on 3 January, 24 January and 7 March, 1942, respectively. On the intermediate dates mosaic incidence ranged between 26 and 31 per cent but on 21 March, 1942, only 3·8 per cent of the plants exhibited mosaic symptoms.

The observations recorded above show that in the second potato crop mosaic incidence after the third week of March was apparently the lowest in the case of all the three varieties. The masking of mosaic symptoms occurred most abruptly between 14 and 21 March. Figs. 1, 2 and 3 show the extent of masking of disease symptoms on different dates in potato varieties, *Phulwa*, *Darjeeling Red Round* and *White Round* respectively.

Mosaic incidence was also recorded in 17 foreign varieties of potatoes. The seed tubers of most of these varieties were obtained from the Punjab and were sown in triplicate in a well-manured plot on 27 December, 1941. Symptoms of mosaic in individual plants were recorded four times during the growth of the crop. The observations were continued as long as the plants were quite green. When the first signs of maturity of plants were observed, the observations were discontinued. It was observed that the apparent mosaic incidence was high in the last week of February and in the second week of March but there was an appreciable fall in the third week of March in the case of all the varieties. Apparent mosaic incidence on 1 April was *nil* in most of the varieties and in others it had fallen from 1/5 to 1/20 of the maximum recorded for a particular variety, showing that disease symptoms in most of the infected plants of all the varieties under observation had become masked.

Observations on first potato crop: Seed potatoes of varieties *Phulwa* and *Darjeeling Red Round* were planted in two plots on 30 September, 1942. The mosaic symptoms in individual plants were recorded.

In the case of the variety *Phulwa*, 31·5 per cent of the plants showed mosaic symptoms on 30 October, 1942. The incidence of mosaic between 6 November, 1942, and 18 January, 1943, ranged between 43 and 68 per cent. The maximum infection of 68·3 was observed on the latter date. On this date about 9 per cent of the plants were new cases of infection, about 8 per cent being cases of Negligible Mottle and 1 per cent Borderline Mild Mosaic type. Some masking of symptoms occurred between 20 December, 1942, and 7 January, 1943.

In *Darjeeling Red Round* 17·6 per cent of the plants exhibited mosaic symptoms on 30 October, 1942, after which date there was a regular rise in disease incidence up to 11 January, 1943, when a maximum of 82·01 per

cent was registered excepting on 10 December, 1942, when symptoms in 4 per cent of the plants were masked.

In another plot, where plants of the variety *Phulwa* had been raised in two lots, data regarding disease incidence on different dates were recorded. In neither lot was there any appreciable masking of symptoms of diseases.

The observations recorded for the first and second plains crops show that under the field conditions masking of mosaic symptoms in the first crop is negligible as compared to the second crop and that masking of *Negligible* and *Borderline Mild Mosaic* mainly occurs. In order to study the mosaic incidence in a field it is therefore essential that the plants be kept under observation throughout the growing period of the crop.

Yield in relation to mosaic

During the first potato crop in 1941-1942 yields of individual plants raised from tubers obtained from 25 mosaic-affected and 25 apparently healthy plants collected in March, 1941, were taken. The data indicated that the number of tubers in the plants grown from parents affected by *Negligible Mottle + Borderline Mild Mosaic* and *Severe Mosaic + Borderline Severe Mosaic* was lower than that obtained from healthy parents and that the percentage reduction in yield was 30 and 55·2 respectively in comparison with that of apparently healthy parents. It was also observed that the plants affected by mosaic mature earlier than the healthy plants.

In another experiment, where the crop had been planted on 30 September, 1942, yields of individual plants of *Phulwa* variety showing different grades of mosaic symptoms were taken. The average number of tubers and average outturn per plant obtained from infected as well as from apparently healthy plants are given in Table I. The percentage reduction in yield in the case of diseased plants is also indicated.

TABLE I

Effect of mosaic on yield

Symptoms	Yield per plant		Percentage reduction in yield	
	Average number of tubers	Weight (in oz.)	No. of tubers	Weight in oz.
Apparently Healthy	27·4	7·6	—	—
Negligible Mottle	22·5	5·6	17·8	25·5
Borderline Mild Mosaic	20·7	4·2	24·4	45·1
Borderline Severe Mosaic	15·5	2·0	43·4	73·5
Severe Mosaic	6·6	0·6	76·0	92·3

The data clearly indicate that yield from plants affected by different types of mosaic is lower than that obtained from apparently healthy plants. The percentage of reduction in yield varied with the intensity of mosaic symptoms, being the highest in severe types of mosaic.

In 1942-1943 season, potato tubers of *Phulwa* variety raised from apparently healthy plants as well as from plants exhibiting different mosaic symptoms were passed over various riddles and the weights of tubers over each riddle were recorded. The results are summarized in Table II. Column 1 gives the class of symptom exhibited by the plant. Columns 2, 3 and 4 give the average weight of 100 plant tubers over various riddles expressed as percentage of healthy ones which has been taken to be 100. Column 5 gives total yield expressed as percentage of healthy ones and column 6 shows the percentage loss in total yield due to different grades of mosaic.

TABLE II

Yield per 100 plants over various riddles expressed as percentage of healthy ones

1	2	3	4	5	6
Symptoms	Over $1\frac{1}{2}$ in.	Over 1 in.	Below 1 in.	Total yield	Percentage reduction in total yield
Healthy	100·0	100·0	100·0	100·0	*nil*
Negligible Mottle + Borderline Mild Mosaic	45·8	82·1	49·6	89·2	10·8
Mild Mosaic	58·8	68·7	78·6	73·1	29·9
Borderline Severe Mosaic	100·0	48·4	89·3	70·1	29·9
Severe Mosaic	0	15·8	28·3	21·3	78·7

In 1943-44 season, the yield from individual plants of the *Phulwa* variety showing different grades of mosaic was recorded. The outturn from plants showing similar mosaic symptoms and from apparently healthy plants was passed over various riddles. The results are recorded in Table III. Column 1 gives the condition of the plants, columns 2, 4, 6 and 8 show yield per 100 plants over various riddles and columns 3, 5 and 7 show yield expressed as percentage of the total yield of healthy plants. In column 9 similar figures are given for the total yield due to different types of mosaic.

TABLE III
Yield per 100 plants in ounces

Symptoms	Over $1\frac{1}{2}$ in.		Over 1 in.		Below 1 in.		Total		Percentage reduction in total yield
1	2	3	4	5	6	7	8	9	10
Apparently Healthy	185·0	12·50	830·0	56·30	460·0	31·20	1475·0	100·0	..
Negligible Mottle	82·0	5·51	498·5	33·80	341·8	23·19	922·3	62·50	37·80
Borderline Mild Mosaic	45·7	3·10	311·4	21·11	342·8	23·24	699·9	47·45	52·55
Mild Mosaic	50·0	3·39	400·0	27·11	216·6	14·70	666·6	45·20	54·80
Borderline Severe Mosaic	0	0	150·0	10·17	250·0	16·94	400·0	87·11	72·89
Severe Mosaic	0	0	75·0	5·08	100·0	6·78	175·0	11·86	88·14

The data show a regular reduction in yield according to the severity of mosaic. It is also observed that the reduction in yield is not restricted to any particular group, i.e. over $1\frac{1}{2}$ in. or below 1 in.

The data collected during the past three years in order to study the effect of mosaic on yield clearly show that the reduction in yield brought about by the severe types of mosaic is very great as would be expected. Furthermore, the reduction due to *Negligible Mottle, Borderline Mild Mosaic* and *Mild Mosaic* is also very considerable. The loss to the cultivator due to *Negligible* and *Mild Mosaic* is on the whole, very appreciable because of their widespread occurrence both in the plains and the hills of Northern India.

Acknowledgement

The author's thanks are due to Dr G. Watts Padwick for his keen interest during the course of this investigation. Assistance given by Mr T. B. Lal is gratefully acknowledged.

WEED INCIDENCE IN MANURED LAND

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It is a common experience of farmers that fields manured with cattle-dung manure are very weedy and need a closer attention in cleaning and inter-culture. This greater weed incidence in manured fields is found to be due to the presence of extraneous weed seeds in the manure itself, which get dispersed in the land and grow vigorously because of the ample plant food. Is it possible to destroy weed seeds effectively during the preparation of manures and thereby mitigate the weed-problem? Our experience in composting town-refuse is encouraging in this direction.

Destruction of weed-seeds by composting

The main bulk of town-refuse compost is made up of *katchra* which comes from such varied sources that it is not surprising to find an unusually large number of weed seeds in it. In the preparation of compost, night-soil is applied to a layer of *katchra* spread in a trench, in the proportion of 1 : 1 by weight. About five to six layers of *katchra* and night-soil are thus filled in one trench and the refuse processed in this manner is left undisturbed for a period of about six months by which time it is converted into a well-decomposed mass of manure. Within three to four days of the processing, described in brief above, a large amount of heat is generated and temperatures above 55°C. are usually attained. The high temperature level in the decomposing refuse continues for over two months and gradually the temperature falls down to about 45°C. by the time the manure is ready for sale. It is found that this intense heat developing in the manure effectively destroys almost all weed-seeds originally present in the refuse.

Trials with different manures

The above fact has been attested experimentally. In a trial conducted in pots with four replications, the following manures were applied at the rate of eight tons per acre: (1) Town-refuse compost, (2) Cattle-dung (farm-yard) manure and (3) Poudrette manure (night-soil trenched without the addition of *katchra*). (4) A control, without any application of manure, was also run. No crop was grown in the pots, but the weeds emerging were uprooted and a count of the weeds removed from each pot was recorded. The experiment was continued till no more weeds grew. The number of weeds in each treatment in an area of 7·1 sq. ft. was as follows:

1. Town-refuse compost	.. 34
2. Cattle-dung manure	.. 53
3. Poudrette (night-soil manure)	.. 70
4. Control	.. 39
Critical difference for significance ($P = 0{\cdot}01$)	.. 14

Results of the trial

The above results are of considerable practical importance. It is observed that town-refuse compost treatment does not show a larger number of weeds as compared to the control showing thereby that its application does not add any extra weeds to the soil. On the other hand, a large increase of weeds is observed as a result of the application of the other two manures, the incidence being nearly one and a half to two times that in the case of the control. This shows that cattle-dung manure and poudrette both contained weed seeds which retained their viability throughout the course of decomposition.

High temperatures destroy weed-seeds

It is interesting to note in this connection that during the preparation of cattle-dung manure or poudrette the heat generated as a result of rotting is not very high. Carbonaceous fractions which can develop considerable heat on decomposition are not contained in animal or human excreta, as they are absorbed in the process of digestion by the animal system and used for production of body heat. Hence during the rotting of cattle-dung or night-soil alone, the temperature does not go beyond

40°C. and this temperature level is not high enough to destroy weed-seeds. On the other hand, town-*katchra* is rich in the carbonaceous substances which generate considerable heat on decomposition which serves to destroy weed seeds.

It is possible to exploit the principle of heat development in rendering cattle-dung or farm manure free from weed seeds. If fairly large quantities of litter-waste from the feeding bier and other suitable crop wastes, are mixed with dung and then the material is put into manure pits and properly composted, it will be possible to generate enough heat to destroy weed seeds.

In short, dung should be used as a starter for compost preparation rather than for preparing cattle-dung manure out of it. This will result in a two-fold advantage. The manure will be of good quality, free from weed seeds, and the total output of manure would be considerably increased because of the use of a large quantity of additional refuse material.

SOW GOOD SEED

FROM harvesting to seeding time, farmers must apply themselves to many kinds of labour, such as ploughing, harrowing, draining, in order to prepare the land and destroy weeds. After these many hours of toil in preparing the land they should not spoil their efforts by using poor quality seed, full of weeds, and of a variety unsuitable to the district, states A.E. Ouellette, Dominion Experimental Farm, Lennoxville. However fertile, well-drained, or prepared the soil may be, it will return only what it receives. That is why the choice of seed is an important factor in farm management. A few years ago, during the depression, some farmers thought to save money by buying cheap leguminous seed without regard to quality or origin. Great was their disappointment at the failure of their crops. The cheapest seed became the most expensive after all. Its poor germination, lack of uniformity, and chiefly the weeds it contained, together with the loss of the crop, all helped to make the cost prohibitive.—*Department of Agriculture*, Canada.

PRODUCTION OF FODDER GRASSES IN INDIA

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THE inadequate supply of feeding stuffs is the most important factor which stands in the way of maximum production from Indian cattle. The situation is all the more complicated, because this lack of food is telescoped with general nutritive inferiority of the existing stable fodders constituted mainly of straws from cereal and millet crops. The exigencies of the war has further revealed the abjectness of the situation; the half-famished Indian cattle have suddenly been called upon to supply the extra motive power for the increased demand of the 'grow more food campaign', and to produce at the same time more milk and milk products for maintaining the national health. It has not taken long to realize that the success of the campaign has to rest largely on how the drive for 'grow more fodder' is planned. The survey of the pre-war situation in regard to fodder-crop production had shown that by far the major portion of the arable land of the country is devoted to cash crop production and the proportion for exclusive growing of fodder-crop is negligible. In some of the major provinces, to safeguard the requirement of livestock, the acreage under fodder-crop needs to be increased by 12 to 50 times[1].

While there is this paucity of acreage for cultivated fodder, properly developed grass lands are few in India.

There are seemingly vast areas for grazing and harvesting grass crop which are preserved by the Forest Department[2]. Although the area is vast, Indian cattle can make very little out of forest grazing. For example, the higher Himalayan forests are practically unused, and the great belt of forests along the foot hills of the Himalayas in Bengal and the United Provinces is out of reach of the cultivators. In fact, out of 43 million head of cattle in the United Provinces, only one and a half million or 3·5 per cent make any use of forest grazing. In the Central Provinces, Bombay and Madras, where the forests are interspersed amongst the cultivated lands, grazing is comparatively better, but even so, it is mostly confined to the outer fringes of each forest block. Only in the Punjab is the incidence of forest grazing heavy. Any possibility of husbanding forest grass by cutting for hay and silage making is precluded because of tremendous transport difficulties.

In the open expanses of the Indian plains, there are also vast areas of land never seriously used for cultivation purposes. In these so-called waste lands every year grass crops of varying quantity and quality grow. Due to the lack of proper husbanding, much of this grass quickly grows to maturity and later dries up. The top growth returns to the soil after being decomposed by rain and sun. In the following year with the advent of monsoon the old and exhausted plants are replaced by new seedlings to which they themselves have given existence and thus, year after year a constant natural replacement of herbage takes place. It is in these waste lands that suitable reclamation projects can be adopted to turn them into useful pastures and fields for harvesting grass crops.

In recent years, schemes are being considered to study the problem of mitigating the acute shortage of right-quality fodder for Indian livestock. One of these schemes is concerned with the exploration of suitable types of indigenous grasses which can be produced in large scale in the reclaimed *barani* lands. Some headway has already been made in studying the composition and nutritive value of a number of widely prevalent indigenous species. These preliminary studies have revealed that there are some Indian grasses which may be considered good sources of nutrients. However, a considerable amount of research, particularly on agricultural aspects of grass production, has yet to be carried out before any final selection can be made of grass species which can be grown extensively in the different regional areas of this country.

[1] *Animal Husbandry and Crop Planning in India* by K. C. Sen and S. C. Ray (1941). *Science and Culture*, 6, 684-689

[2] Note by the President, Forest Research Institute, Dehra Dun, in the *Proceedings of the First Meeting of the Animal Husbandry Wing of the Board of Agriculture*, India, 1933

Izatnagar experiments on grass production

For the past several years in the estate farm of the Imperial Veterinary Research Institute at Izatnagar, an investigation has been carried out with several varieties of indigenous grasses which grow widely in the United Provinces to study (a) the habit of growth, (b) the duration of life of the ley, (c) the yield, (d) the number of cuts available just at the flowering stage and (e) the availability of green cuts outside the monsoon periods. In order to make a comparative study, a few well-known cultivated grasses were also grown under similar environmental and cultural conditions. The varieties of grasses grown are given in the following list :

A. *Indigenous grasses*
1. *Jenewah* (*Andropogon ischaemum*)
2. Golden crown (*Paspalam dilatatum*)
3. *Kolukattai* (*Pennisetum cenchroides*)
4. *Bhanjura* (*Apluda varia*)
5. *Surwala* (*Andropogon contortus*)

B. *Cultivated grasses*
1. Rhodes grass (*Chloris gayana*)
2. Guinea grass (*Panicum maximum*)
3. Napier grass (*Pennisetum purpureum*)

To grow these grasses, an uniform area of light sandy soil was selected. The area was sub-divided into plots of 1/20th of an acre each, for the eight species. Before planting the grasses, each plot was dressed with 10 mds. of well-rotted farmyard manure. In the month of July-August, 1940, as soon as the monsoon had properly set in, the roots of each species were planted at a distance of 2½ ft. apart. The plots were under experimental observation throughout the period which terminated at the end of November, 1944.

During the period covered by July, 1940 to November, 1944, the record maintained of rainfall is given in Table I.

TABLE I

Inches of rainfall during July, 1940 to November, 1944

		1940	1941	1942	1943	1944
January	1st half	—	0·69	—	1·92	*nil*
	2nd half	—	0·66	2·95	0·06	2·32
February	1st half	—	0·12	—	*nil*	*nil*
	2nd half	—	0·25	2·34	*nil*	—
March	1st half	—	0·24	*nil*	*nil*	*nil*
	2nd half	—	*nil*	*nil*	*nil*	1·19
April	1st half	—	*nil*	*nil*	0·21	1·48
	2nd half	—	*nil*	*nil*	*nil*	*nil*
May	1st half	—	0·95	*nil*	0·20	*nil*
	2nd half	—	*nil*	*nil*	*nil*	*nil*
June	1st half	—	2·79	*nil*	0·06	0·83
	2nd half	—	0·60	7·04	4·42	1·00
July	1st half	8·43	0·23	6·52	0·57	6·25
	2nd half	13·19	1·69	6·32	6·61	6·50
August	1st half	12·49	9·61	6·78	11·33	2·41
	2nd half	5·70	3·92	6·58	10·13	2·21
September	1st half	*nil*	6·06	2·89	4·75	2·55
	2nd half	2·23	*nil*	0·75	0·50	*nil*
October	1st half	*nil*	*nil*	*nil*	*nil*	*nil*
	2nd half	*nil*	*nil*	*nil*	*nil*	*nil*
November	1st half	*nil*	*nil*	*nil*	*nil*	*nil*
	2nd half	*nil*	*nil*	*nil*	*nil*	*nil*
December	1st half	0·22	0·08	*nil*	*nil*	—
	2nd half	0·76	*nil*	0·80	*nil*	—

From the data presented in Table I, it is apparent that monsoon in Izatnagar during the course of present study usually started in the middle of June and terminated at the end of September. Practically all the grasses, which grew since the last cut in monsoon, reached the flowering stage sometime in November and according to the plan of the experiment were duly cut. As there was a long spell of dry period following the month of November, the plots were irrigated at the end of this month. The pre-monsoon crop of the different grasses was ready for harvesting at the end of March or at the beginning of April. As soon as the harvesting was over, the plots were given two successive irrigations, one, in the middle of April and the other at the end of May, to keep the sward in a good condition during the dry hot period between April and middle of June. The grass plots were hoed twice in a year, once in the month of November and a second time in the month of April.

The majority of the grasses took 3 to 4½ months to get established. *Bhanjura* and *Surwala* were exceptions; these grasses took over nine months to establish themselves. This delay might have been partly due to the relatively advanced period of monsoon when their roots were planted. After the indigenous species got properly established and with subsequent progress of growth, it was observed that like the cultivated grasses they developed

the habit of growing in thick clumps. This clumpy growth was due to the method of planting by roots and leaving interspaces. Although the method permits easy hoeing and inter-culturing, it is unsuited for large-scale production of grass where the use of a mower is indispensable at the time of harvesting. A separate experiment was carried out to observe the habit of growth of the indigenous species when the grasses were grown by broadcasting the seeds. In this method of propagation, thick clumpy growth was found to be markedly less and no difficulty could be experienced in running the mower through the grass fields. The grass grown by seed, however, took relatively longer time to establish.

The results obtained of the trial during the four successive years are set out in Table II.

It may be seen from the data presented in Table II that following their plantation in the previous monsoon, *Jenewah* and Golden Crown amongst the indigenous species, and Rhodes amongst the cultivated grasses, gave the maximum yield in the first year (1941). The other grasses reached the peak of their yield in the second year (1942). The yield of all grasses, excepting *Jenewah* and Golden Crown, tended to fall from the third year of their stand. The downward trend became very pronounced in the fourth year. Under the environmental and cultural conditions of the present experiment, it was apparent that the vigour of the sward in the case of all grasses remained potent for a period of only three years.

Amongst the indigenous grasses, during the period ranging between 1941 and 1943 when the sward was in full vigour, although *Jenewah* gave the largest number of cuts, the actual yield was the highest for *Surwala*; the yield of *Bhanjura* being a close second. During the same period, amongst the cultivated grasses, inspite of its giving the same number of cuts as Guinea, the Napier grass proved to be the heaviest yielder. A comparison of yield as well as number of cuts obtained from indigeneous and cultivated species would show that the best performer (*Surwala*) amongst the former is barely half as good as the best (Napier) amongst the latter.

In order to present a clearer picture of the duration of supply of green cuts the data in Table II has been re-arranged in Table III showing the number of cuts and yield obtained during pre-monsoon, monsoon and post-monsoon periods.

The data in Table III show that in the pre-monsoon period of first year's growth, *Jenewah* and *Kolukattai* gave double the number of cuts as compared to the other indigenous species, but the total yield of *Jenewah* and the yield per cut of *Kolukattai* were definitely lower than those of the other grasses obtained in a single cut. The pre-monsoon productions, in the case of all the indigenous grasses were considerably reduced in the second year, and from the third year onward it became *nil*. In the post-monsoon period, three out of five indigenous grasses gave a cut each in the first year. Except for *Jenewah* and Golden Crown, the post-monsoon production improved considerably in the second year. In subsequent years, although the grasses gave a cut each in the post-monsoon period, the yields were very poor.

The pre-monsoon production of the cultivated grasses was heaviest in the first year. In the following two years, the production was significantly reduced and became relatively negligible in the last year of observation. Of the three species, Napier grass gave the highest yield in the pre-monsoon period. The post-monsoon production of all the cultivated grasses showed the peak in the second year but recorded a steep fall in the year following. The position was found to be further worsened in the final year. Napier grass again, amongst the cultivated species, gave the highest yield in the post-monsoon period. A comparison of yield figures of indigenous and cultivated grasses at pre- and post-monsoon periods during the four years of observation would show that in quantitative production outside the growing season, the cultivated grasses excel the indigenous species.

The results of the present investigation lead to the conclusion that cultivated exotic grasses, specially Napier and Guinea, are definitely superior producers as compared to the indigenous varieties. When the superior productive capacity of cultivated exotics is established, the question arises why the growing of indigenous species should be considered at all in the *barani* lands to be opened in the future.

In chalking out the policy for grass production it will be necessary to consider aspects other than relative yield. Two such important considerations would be (a) the cost, labour and organization involved in the production and (b) the number of effective channels of disposal of the produce. In the case of cultivated grasses, propagation will be both laborious and costly as it involves multiplications by roots,

whereas indigenous grasses can be grown simply by broadcasting the seeds. In the same way, since cultivated grasses grow in thick clumps and no mechanical contrivance can be used in cutting, there will be greater involvement of labour and organization to secure the harvest by hand. Normally, cut grasses of cultivated species are used either as green fodder or as conserved silage. The indigenous grasses, on the other hand, can be utilized in four different ways, viz. as pasture, green fodder, silage and hay. Because of the variety of ways by which the indigenous grasses can be utilized, there should never be any complication in controlling their timely disposal. These advantages in production and effective disposal should greatly compensate the relatively lower yield of the indigenous grasses. In the future programme of grass production in *barani* lands therefore, indigenous species will always hold their own when the question of selection of the type arises.

TABLE II

Yield of grasses in lb. (on fresh basis) per 1/20th of an acre

Name of the grass	Date of sowing	Interval before 1st cut (Months)	Interval before 1st cut (Days)	Yearly performance: 1940 No. of cuts	1940 Total yield	1940 Average yield per cut	1941 No. of cuts	1941 Total yield	1941 Average yield per cut	1942 No. of cuts	1942 Total yield	1942 Average yield per cut	1943 No. of cuts	1943 Total yield	1943 Average yield per cut	1944 No. of cuts	1944 Total yield	1944 Average yield per cut
Indigenous grasses																		
Jenewah ..	11-7-1940	4	17	1	357	—	6	1851	308	4	847	212	3	1015	338	3	547	182
Golden Crown ..	11-7-1940	4	17	1	448	—	4	2052	513	3	1782	594	2	1844	922	3	480	160
Kolukattai ..	18-8-1940	3	10	1	376	—	4	1480	370	4	2076	519	2	1155	578	3	495	165
Bhanjura ..	31-8-1940	9	12	*nil*	—	—	5	1747	349	3	2748	916	3	1557	519	3	1175	392
Surwala ..	2-9-1940	9	10	*nil*	—	—	3	1231	410	3	3652	1217	3	2371	790	3	1389	463
Cultivated grasses																		
Rhodes ..	11-7-1940	4	17	1	546	—	5	2602	520	4	2142	535	3	1831	610	3	720	240
Guinea ..	14-7-1940	3	8	1	1208	—	6	3312	552	3	3615	1205	3	1961	654	3	955	318
Napier ..	14-7-1940	3	7	1	1160	—	6	7216	1203	3	4861	1620	3	4357	1452	3	2030	677

TABLE III

Yield of grasses in lb. (on fresh basis)

Performance in successive years

Name of the grass	1941						1942						1943						1944					
	Pre-monsoon		Monsoon		Post-monsoon		Pre-monsoon		Monsoon		Post-monsoon		Pre-monsoon		Monsoon		Post-monsoon		Pre-monsoon		Monsoon		Post-monsoon	
	No. of cuts	Total yield	No. of cuts	Total yield	No. of cuts	Total yield	No. of cuts	Total yield	No. of cuts	Total yield	No. of cuts	Total yield	No. of cuts	Total yield	No. of cuts	Total yield	No. of cuts	Total yield	No. of cuts	Total yield	No. of cuts	Total yield	No. of cuts	Total yield
												Indigenous	*grasses*											
Jenewah ..	2	289	3	1254	1	308	1	107	2	540	1	200	*nil*	*nil*	2	897	1	118	*nil*	*nil*	2	435	1	112
Golden Crown ..	1	900	2	750	1	402	1	412	1	1170	1	200	,,	,,	1	1760	1	84	,,	,,	2	400	1	80
Kolukattai ..	2	665	2	815	*nil*	*nil*	2	371	1	840	1	865	,,	,,	1	1013	1	142	,,	,,	2	355	1	140
Bhanjura ..	1	366	3	1181	1	200	1	253	1	1232	1	1263	,,	,,	2	1359	1	198	,,	,,	2	1050	1	125
Surwala ..	1	465	2	766	*nil*	*nil*	1	274	1	1824	1	1554	,,	,,	2	2266	1	185	,,	,,	2	1334	1	55
												Cultivated	*grasses*											
Rhodes ..	1	1050	3	1139	1	413	2	741	1	720	1	680	1	526	1	1097	1	208	,,	,,	2	580	1	140
Guinea ..	2	1258	3	1401	1	653	1	283	1	1848	1	1484	1	267	1	1405	1	289	1	230	1	450	1	275
Napier ..	2	2090	3	4226	1	900	1	280	1	2750	1	1831	1	1160	1	2747	1	450	1	330	1	1420	1	280

SPROUTLING METHOD OF GROWING POTATOES

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THE potato has hitherto been propagated from the tubers. Each tuber possesses a number of eyes—the buds—which under favourable conditions produce shoots—the sprouts—and these when they emerge above ground, give rise to the vegetative parts of the plant. In the initial stages of growth, the sprouts feed upon the mother tuber and they thus have no independent existence, but eventually the mother tuber decays and each sprout, after it has developed roots, establishes itself as an independent plant. Being dependent on the mother tuber, it has hitherto been considered necessary to plant a part of the tuber along with the eyes. Experience and experiments in the past have indicated that a slice of tuber with two eyes (to ensure the development of at least one good sprout) is an ideal seed-piece. As thousands of seed-pieces are required to plant an acre of crop, several difficulties in the way of production, storage, handling and transport of the potatoes for seed purposes arose. Recently several workers have shown that it may not be essential to plant tuber pieces of two ounce weight and that a crop could be raised from 'chips', 'peelings' or 'tops' which means the planting of one or several eyes along with just a small slice of the flesh. It would thus appear that detachment of the eye with either a large or a small piece of the flesh is considered essential for raising a potato plant. Recent experiments by the writer have shown that it may not be essential to plant the tuber or a part of the tuber. During the course of these investigations carried out at the Simla Potato Breeding Station[1], a tuberless method of raising the crop has been developed. This method consists of raising the potato plant from the sprouts. The 'sproutling' method of cultivating the potatoes, if successfully worked out may result in great economy and many problems (especially those of cost, storage and transport of the seed) now facing the potato industry of this and other countries may find an easy solution. It is, therefore, hoped that this note will serve as a basis for further trials especially in such tracts where irrigation facilities are readily available and intensive methods of cultivation are practised.

What is a sproutling

A sproutling may be defined as a young potato plant derived from one or part of a sprout. The sprout is the initial of a future plant but as it has to draw its nourishment from the mother tuber it cannot be removed and planted directly in the field. Attempts made in this direction have given very disappointing results; very few, if at all any, sprouts developed and such plants had often poor vegetative mass and set only a few small tubers. If, however, suitably treated and allowed to root, the sprouts can be made to grow independently of the mother tuber. The plants produced are vigorous and yield as well as those propagated in the normal way.

How to secure sproutlings

Sprouts when they are about $1\frac{1}{2}$ to $2\frac{1}{2}$ in. long are removed and planted in beds. During planting the apical region of the sprout is allowed to remain above the soil while the rest of it lies buried in it. Planting may be done in rows at spacing of 1 in.$\times$1 in. to $1\frac{1}{2}$ in.$\times 1\frac{1}{2}$ in. During planting it is advisable to see that the growing point is not damaged. If, however, it is accidentally broken, it can still be useful as it would develop new shoots below. It cannot yet be said with certainty if any injury to the growing point has any deleterious effect on the plant. The only difference that has been noticed is the delay in the formation of the leaves in the case of sprouts with damaged growing points. Certain varieties produce exceedingly long sprouts, some times exceeding 12 in. in length. Such sprouts can be divided into suitable pieces of two to four inches in length. Care must, however, be taken to leave at least three nodes on each piece. It is desirable to bury two nodes in the soil leaving one or two nodes above it.

The sprouts after they have been planted develop green colour within two to three days' time and at this stage the sprouts have already established themselves. In another three to four

[1] Financed by the Imperial Council of Agricultural Research.

FIG. 1.
Crop raised
from sproutlings

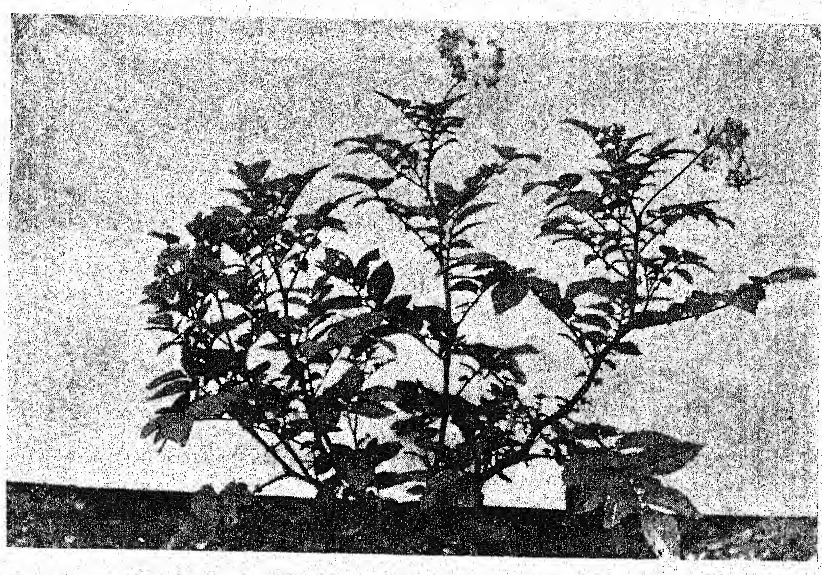
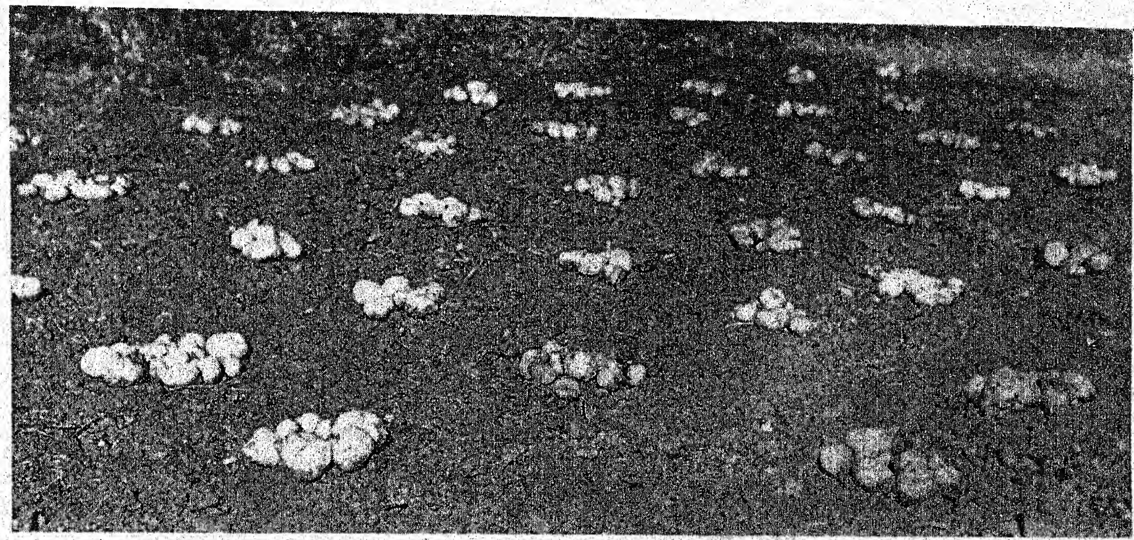


FIG. 2.
A full grown plant
from a sproutling



[illegible] FIG. 3. Yield of [illegible]

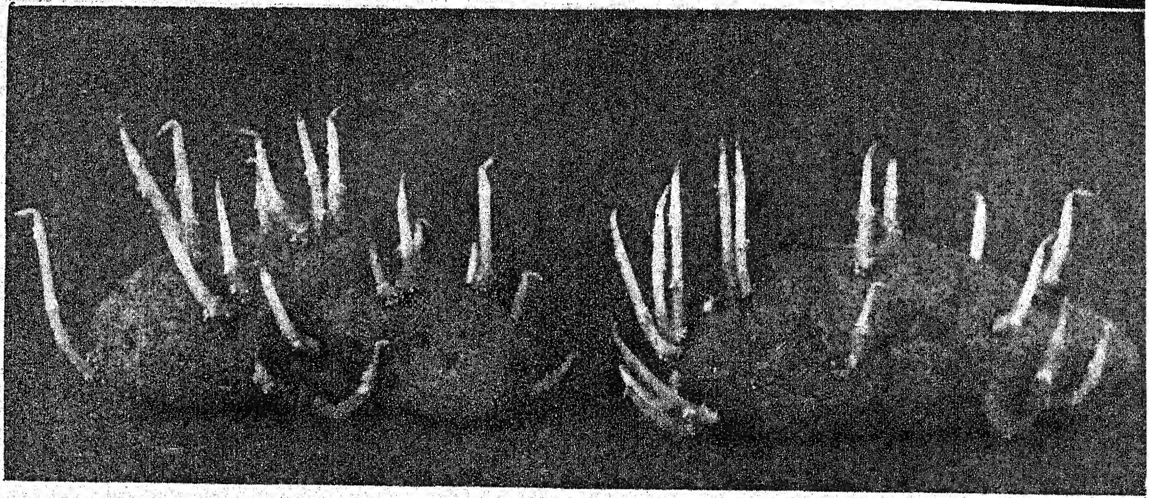


FIG. 1. Sprouts on tubers

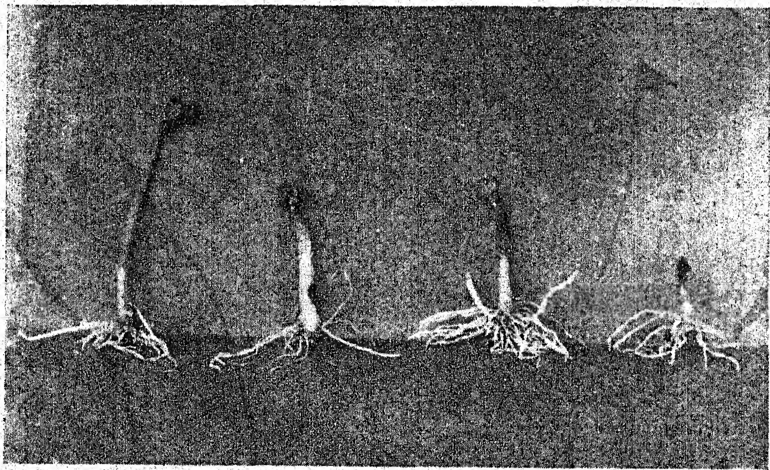


FIG. 2. Rooted sprouts—one week old

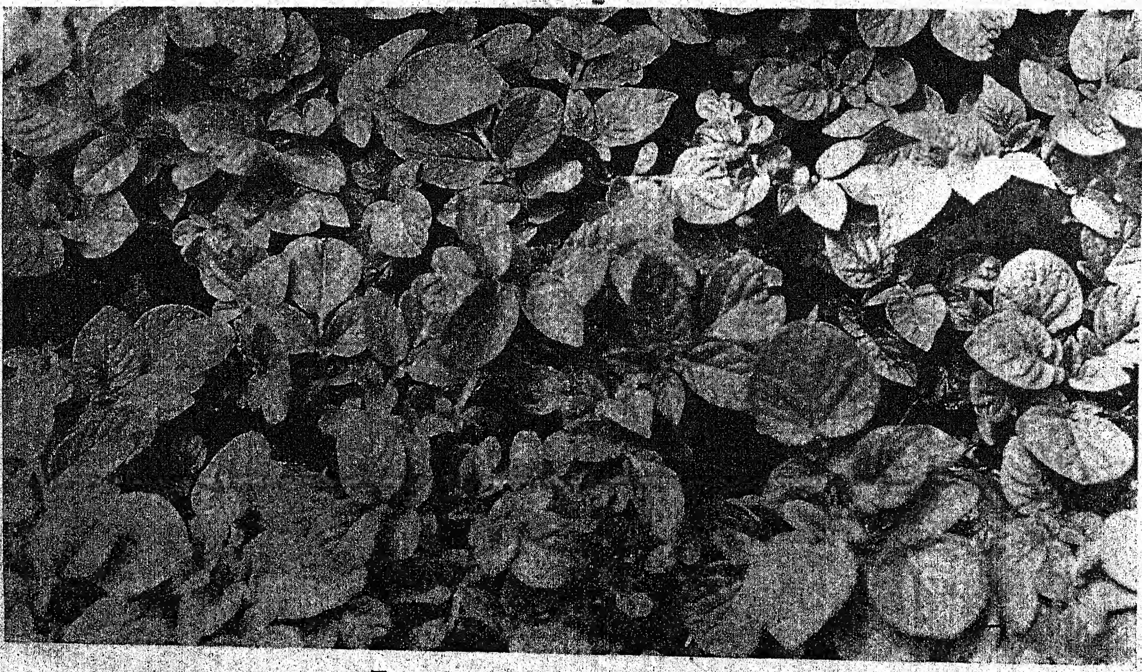


FIG. 3. Sproutlings—3 weeks old

days young shoots will appear at the growing point. If the growing point is not intact small buds will appear on the nodes above the ground and these will later develop into shoots. A sprout develops a crown of young, though fully-formed, leaves within two to three weeks' time. At this stage the sprout has established independent existence and when it is about three to four inches in height it may be transplanted in the field. The sproutlings being very hardy they can be dug out (if they are pulled out the roots may be damaged), put in a basket, and carried into the field for planting.

Preparation of beds and after-care

The beds should be carefully prepared and water readily available. The sprouts grow well in moderate heat. In the hills the sprouts can be planted in beds under direct sun. If it is very hot it may be desirable to cover the beds during the first two or three days. In the plains where the summer temperature is still very high at the time when the potatoes are normally planted, it is advisable to select a site which is not open and directly exposed to the sun throughout the day. A site under the shade of a tree near a well may be an ideal one. Prepare the beds in the usual manner as is done for sowing chilli or brinjal seeds. The length and breadth of the bed can be adjusted according to convenience. If the sprouts are planted at a spacing of 1 in. × 1 in. a 6 ft. × 3 ft. bed would accommodate 2,600 sprouts.

After the sprouts have been sown, frequent waterings during the first week, so as to keep the beds in a moist condition, are necessary. Later, however, fewer waterings are needed and the interval may be adjusted as the local conditions demand. If it is very hot and beds exposed directly to the sun, it is desirable, during the first week or so, to cover the beds. In experimental work, covering with the gunny sheets has given excellent results. Covering the beds rather loosely with green twigs may be practised with advantage. Care is, however, needed to arrange the twigs in such a manner so as to avoid damaging the sprouts below. After about a week when the sprouts are showing first signs of growth the covering may be removed.

Yet another convenient way to sow the sprouts may be to plant them in small *kiyaries* (beds) similar to those used for sowing onions, etc. This method has an advantage in that the watering of the beds will be both quick and convenient. To secure the best results it is necessary that the beds, whether raised or depressed, should be well-manured and the soil loose in texture. Small and frequent doses of sulphate of ammonia (if sulphate of ammonia is not available, cow-dung decoction will be a very good substitute) give a good start to the sproutlings.

Sprouting the tubers

The methods of sprouting the tubers before planting is not very well known in this country. Few, if any, recognize the merits of sprouting the tubers. In western countries and in America all the progressive growers have relatively recently adopted the practice of sprouting the tubers prior to planting and the methods of sprouting are generally known.

The best method to make the tubers sprout is to place them in flat trays like those used in European countries. The trays are so designed that a series can rest one upon the other. This is made possible by providing corners which project about four inches above the sides on which the next tray rests. These corner posts also serve as handles for removing the trays from one place to another. In western countries large growers possess specially designed houses where thousands of such trays can be stocked. The primary object of placing the tubers in flats is to allow the tubers to sprout properly and reduce the possibility of damage during the course of handling.

Experience in this country has shown that in hill regions where the potato is sown in summer, the potatoes sprout more quickly if placed loosely in small baskets than in trays. This is because the moderately high temperature and humidity, which are maintained in the heap, induce the tubers to sprout quickly. In bright light the sprouts remain short and stubby and are not easily broken off. On the other hand in complete darkness, long etiolated and rather weak sprouts are formed. It is, therefore, best to provide diffused, moderate light just enough for the sprouts to grow rapidly without being etiolated.

Under normal conditions the apical sprout at the crown end is the first to develop and this, if allowed to grow, will inhibit the sprout formation on the other eyes over the body of the tuber. If, however, the apical sprout is removed as and when it appears, sprouts can be made to grow from all the eyes and these will

be nearly as strong as the apical one. The first crop of sprouts will bear a direct relation with the number of eyes a tuber possesses. Generally 5 to 10 good sprouts may be expected from a medium-sized tuber. After the removal of the first crop a second, a third or even a fourth crop can be made to develop on a tuber. It has been experienced that there is generally a progressive increase in the number of sprouts in the second and the successive crops. A medium-sized tuber with about 10 to 11 eyes can yield a total of over 60 sprouts and on an average 20 to 40 good sprouts can be obtained from a tuber without much difficulty and the mother tuber can also be used finally for seed purposes.

Different varieties give different responses to sprouting treatment. Some varieties like Hybrid 5 and Hybrid 13 produce sprouts mostly towards the crown end and only a few on the eyes over the body of the tuber. On the other hand some varieties like Hybrid 2 and Up-to-date sprout equally well along all the eyes. Sometimes several (about 10 to 15) sprouts may be crowded together towards the crown eyes and in the other cases each sprout may give rise to a number of lateral branches each of which can be treated separately and each of these will produce a good sproutling.

Removing the sprouts

After removal of the apical or the inhibitory sprout, the lateral eyes, under proper temperature and humid conditions, will produce $1\frac{1}{2}$ to $2\frac{1}{2}$ in. long sprouts in about two to three weeks time, depending upon the variety and conditions of sprouting. At this stage the sprouts may be removed. This can easily be achieved by holding the sprout near the top, just below the growing point, and a quick sideways bending is all that is necessary to dislodge the sprout from the eye. Care is necessary in handling the sprouts after removal from the tubers. Fresh sprouts generally give the best results and consequently the sprouts should be removed as and when they are needed in the sproutling plot. If, however, the beds for sowing are not ready the sprouts may be stored in a moist, cool place for a few days. Keeping the sprouts between layers of clean straw or gunny sheets, kept moist by occasional sprays of water, will serve the purpose very well. During transplanting it is desirable not to hold the sprout near the base, for this is the place from where the roots will develop. Growing points if left undamaged will give rise to sproutlings in a shorter time than the ones in which the growing points have been damaged.

Storage and transport

No extensive experiments have yet been made to store the sprouts. Apart from storing for short periods of a week or ten days which can be practised without much difficulty, successful storage for fairly long periods appears to be a practical proposition.

Preliminary experiments have shown that the sprouts can be transported over long distances. Small experimental postal packets have been transferred from one place to another. These have successfully withstood the summer temperature of the plains in the month of April[1]. Much of the success would, however, depend upon the method of packing. It is not yet possible to recommend any specific method of packing but a few points which are likely to be of value are briefly mentioned here. Small bundles of about 100 sprouts each may be loosely kept between packing of green leaves, etc. It may be an advantage to cover the basal end of each bundle with wet moss or some material of a similar nature. This method is likely to prove successful for transporting sprouts over long distances. For sending to nearer destinations the sprouts may be placed loosely between layers of fresh leaves or green grass.

When and how to plant

The sprouts may be planted in beds about three to four weeks earlier than the normal planting season. By the time the conditions are fit for transplanting, the sproutlings will be about four to six inches high and these can easily be dug out and carried to the field. If the temperature at the time of planting is still high it is desirable to delay transplanting. The sproutlings being already in an advanced stage of growth are expected to ripen earlier than the plants raised from seed-pieces and delay in transplanting is not, therefore, expected to delay harvesting. Plant sproutlings along the side of a ridge at a

[1] In August, 1945, ten packets of potatoes, shipped from Cambridge (England), were received at the Simla Potato Breeding Station. The tubers in all the ten packets were almost exhausted through excessive sprouting. Each tuber had produced very long irregularly branched sprouts. These had partially shrivelled and browned during the long period of transit. On their receipt at Simla three to four sprout-cuttings were made from each sprout. Almost all the sprout-cuttings established themselves and gave rise to normal plants which yielded satisfactory crop of tubers.

spacing preferably slightly less than what is generally adopted for planting of the tubers. The fields should be kept well-supplied with moisture for the first week or ten days. This is all the precaution that is necessary. By this time the sproutlings will have established themselves. After this preliminary precaution no special treatment is necessary and similar culture will be needed as required for a crop raised from the tubers.

Good returns at low expense

If developed on a commercial scale the new method of cultivating potatoes promises to be very economical. Some of the advantages of this method are noted below.

Initial expenses of the seed will be considerably reduced. The sprouts being very light in weight can be easily transported either as postal packets or as railway parcels. No elaborate arrangements or special type of railway wagons will therefore be needed. Further the cost of transport will appreciably reduce the initial expenses which the grower has to pay for the seed.

As the sprouts are detached from the eyes and do not carry any part of the flesh or the skin it may greatly reduce the possibility of transmission of many tuber-borne fungal and bacterial diseases.

The sproutling method of growing potatoes would exercise an effective check on the virus diseases which have a seriously deleterious effect on the yield. The tuber does not show any visible sign of virus infection and, therefore, it is not possible to eliminate the virus stocks before the sets are planted in the field. On the other hand, the sproutlings being transplanted after the first crop of the leaves has appeared, makes it possible to select only such plants which are visibly free from virus infection. Therefore, a high standard of health, which has hitherto not been possible for an average grower to accomplish, can be maintained. It is also possible to exercise sprout selection and to discard any such sprouts which are thin or abnormal-looking and which would, if grown, give rise to diseased plants.

Apart from the cultivator's point of view, the sproutling method of cultivating potatoes is of special value for those engaged in maintaining and building up of healthy stocks for certification purposes. It should facilitate 'tuber indexing'[1] and help in building up and multiplying foundation seed-stocks within a very short period.

[1] Tuber indexing is the method of selecting virus-free tubers by observing the plants, raised from a part of the seed tuber, under green-house (insect-proof glass-house) conditions. The remaining portion of such tubers which are free from virus infection are multiplied and foundation seed-stocks thus secured.

CAUSES OF THE WORLD FOOD PROBLEM

THREE chief causes for the world food problem are given by the U.S. Department of Agriculture:

1. Reduction in 1945 of total world food production by 12 per cent per capita below pre-war.
2. Concentration of this reduction chiefly in countries normally dependent on imports.
3. Disruption of distribution in war-torn nations.

The United States and Canada, British Isles and the Middle East are cited as the only large areas where food production in 1945 was relatively favourable. It is pointed out that total food supply in the United States continues at record levels with food production about one-third above the pre-war average, and per capita consumption in the United States now exceeds that of any previous year.

Food shortages are likely to be most seriously felt in the first six months of 1946, with rations in several countries near starvation levels. In continental Europe, only Denmark and Sweden at present have diets approximating pre-war levels.—*The California Citograph*, April 1946.

A PLEA AND A PLAN FOR COOPERATIVE MARKETING OF SUNN HEMP IN INDIA

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IN India, sunn hemp (*Crotalaria juncea*) like most of the other crops is produced mainly by small growers. Their bargaining capacity is poor and holding power low. Individually they cannot, therefore, market their crop to their best advantage.

Defective assembling system

In most cases producers dispose of their sunn hemp to village merchants who apart from paying as low prices as possible do not as a rule pay proper premium for cleaner or superior quality fibre. This system of assembling is a big obstacle in the way of improving the quality of Indian sunn hemp. Consequently sunn hemp heavily loaded with refraction (sticks and dirt) reaches the market so much so that arrivals in some markets contain 40 per cent of fibre and 60 per cent of refraction. In such cases partial cleaning is often done in the assembling markets before despatching the sunn hemp to the baling centres. In doing so the quality of the fibre is sometimes greatly impaired. For instance in some markets of Allahabad district (the United Provinces) sunn hemp is beaten with a blunt chopper in order to break long pieces of sticks with a view to facilitating their removal by shaking. This process bruises the fibre and impairs its strength. The partially cleaned sunn hemp still contains about 30 per cent of refraction.

Low reputation of Indian sunn hemp

At baling centres sunn hemp is cleaned and assorted into two or three grades by each baler according to his own trade mark. Even this cleaning is not adequate and the assorting is irregular with the result that Indian sunn hemp has a low reputation in the world markets. There are probably few other agricultural commodities exported from India about the quality of which complaints have been so persistent as in the case of Indian sunn hemp. The prices of Indian sunn hemp are consequently disproportionately low. In August, 1939, the best Indian green sunn hemp was quoted at £20 to £35 per ton (c.i.f. Antwerp) as against £45 per ton (c.i.f. U.K.) for the lowest quality of Italian hemps and £79 to £80 per ton (c.i.f. U.K.) for the highest. As compared with the other hemps, i.e. Russian and Hungarian hemps the Indian sunn hemp fetched lower prices.

Defects are removable

The main defects in Indian sunn hemp are the unduly high refraction content, the irregularity and unreliability of quality and defective packing. Fortunately all these drawbacks can be removed. An expert witness in his evidence before the Royal Commission on Agriculture stated that he had Indian sunn hemp sown in Italy in the same conditions in which Italian hemp was produced and found the fibre to be superior to the Indian hemp produced in India. He was of the opinion that climatic conditions had nothing to do with the improvement and that what could be done in Italy could be achieved in India as well. With the improvement in the quality of Indian sunn hemp it will not only be possible to get better prices but the demand is also likely to increase considerably. A witness before the Royal Commission on Agriculture had estimated that if Indian hemp were found satisfactory ' consumption could be five or ten times ' of what it was during that period (during the quinquennium ending in 1928-29 export of sunn hemp[1] from India was 28,000 tons while during the period 1939-40 to 1942-43 it was 30,000 tons). It is highly desirable, therefore, that effective steps should be taken to improve the quality of Indian sunn hemp.

Need for cooperative sale societies

An important step towards the improvement and maintenance of the standard of quality of sunn hemp exported from India was taken by the Government of India in November, 1942, when the Sunn Hemp Grading Scheme under the Agricultural Produce (Grading and Marking) Act was initiated.

[1] These figures refer to all types of hemp but consist mainly of sunn hemp.

Under this scheme, grades and grade specifications have been drawn up for the several trade descriptions of sunn hemp and appropriate grade designation marks are applied to bales conforming to the prescribed specifications. The Government also prohibited the export of sunn hemp not graded under the above scheme. The advantage of the scheme can be fully shared by the producers if they market their sunn hemp on a cooperative basis. Sale societies set up for this purpose can also be of help to the producers in securing good seed and advice on such matters as period of harvesting, methods of retting and extraction and grading of the fibre. The balers are also likely to welcome the formation of such societies. At present they generally depute their own paid men to the various markets to safeguard themselves against being cheated by the commission agents but on many occasions their experience is that their buying agents act in collusion with commission agents. The balers give price limits to their buying agents for certain qualities of sunn hemp. The latter, however, buy inferior qualities at lower rates and charge higher rates from the balers, the difference being pocketed by the buying agents and commission agents. Similarly the buying agents make purchases when the rates are low but pass these on as having been purchased at times when higher rates obtained. The balers thus find themselves helpless in the absence of a satisfactory alternative. Thus cooperative sale societies will be advantageous both to the sellers and the buyers by discharging faithfully and more efficiently the services performed by the village merchants on the one hand and the buying agents and commission agents on the other. Besides receiving proper premium for quality the producer will further gain by the elimination of waste in the marketing machinery. If he produces and markets clean hemp, handling and marketing charges on refraction will be saved. For instance sunn hemp received at Shiupur from Raja Talab (an assembling market about 13 miles from Shiupur) contains about 50 per cent of refraction. The cartage is about six annas per maund. If the refraction is reduced to 25 per cent there will be a saving of one anna and six pies per maund of uncleaned hemp in the transport charges alone. Transport charges for refraction from villages to Raja Talab will also be saved. Similarly there will be saving in such marketing costs as are levied on the basis of weight of sunn hemp marketed. A further saving to the extent of three annas per maund of uncleaned sunn hemp spent for cleaning and assorting it at Shiupur can be effected if the producers produce clean hemp and market it after grading. The cooperative sale societies can help them in this task. At the top of this, such societies will be greatly helpful in improving the quality of Indian sunn hemp and thereby establishing its reputation in the foreign markets.

A plan for cooperative marketing of sunn hemp

Sunn hemp for export is mainly produced in the United Provinces, the Central Provinces, Bengal, Bihar and Bombay. It is gratifying to note that attempts are being made in the two first named provinces to organize cooperative societies. The working of these societies may slightly differ in different localities to suit local conditions but the broad lines on which these may be organized are suggested below.

Selection of centres: The societies may in the first instance be started at a few important assembling centres only. Success at a few places will attract attention at others. Moreover experience gained in the beginning will be valuable for speeding up the successful formation of similar societies at other places. The important assembling markets in the United Provinces are Chilbila (Partabgarh), Sheorgarh Siwait (Allahabad), Shiupur (Benares), Raja Talab (Benares) and Chandausi (Moradabad). In the Central Provinces the main centres are Seoni-Chhapara (Seoni), Palari (Seoni), Ghansore (Seoni) and Chaurai (Chhindwara). The important assembling markets in Bengal are Ullapara (Pabna), Charmugaria (Faridpur) and Dhulian (Murshidabad). The main centres in Bihar are Mahrajganj (Saran), Islampur (Patna) and Bihar-Sharif (Patna). The important centres in Bombay are Jhalod and Dohad (Panchmahal), Sankeswar (Belgaum) and Rajapur (Ratangiri). Generally there are smaller assembling centres in the vicinity of the main markets.

After the selection of a centre detailed information on the points given below may be collected from the market concerned and the villages served by it.

(a) *Market enquiry:* (i) Market charges and practices, (ii) names of villages from which sunn hemp is received together with approximate quantities assembled, (iii) share of different assembling agencies in the marketing of sunn hemp, (iv) season of marketing, (v) important

stations to which sunn hemp is despatched and (vi) list of balers who buy from the market.

(b) *Village enquiry:* (i) Area under sunn hemp for fibre, (ii) total production of fibre, (iii) marketable surplus, (iv) needs for finance and (v) other special conditions affecting the marketing of sunn hemp.

Membership: Membership should be confined to the producers of sunn hemp and their credit societies in the area served by the market. Admission fee may be fixed at Re. 1. Each member may be required to take out a share of Rs. 10 each (payable in two years) with a maximum limit of five shares. As the quantities produced by each grower are usually small, membership is bound to be large to make up the volume of business. It should be made obligatory on members to sell their sunn hemp through the society. For the success of the society the loyalty of its members is essential. To ensure this, members have to be educated in cooperative ideals but to begin with, desertion may be penalized by confiscation of share money and profit to the credit of the defaulter.

Management: Supreme authority may be vested in the General Body consisting of delegates, one from each village elected by the local members and one from each affiliated credit society. The General Body should ordinarily meet once a year, a couple of months before the commencement of sunn hemp season. It should elect a Managing Committee consisting of five members to conduct its day to day business. The Registrar, Cooperative Societies, and the Director of Agriculture of the province should nominate one member each from their respective Departments. The Provincial Marketing Officer or his nominee should also serve on the Managing Committee. The office bearers should be elected by the Managing Committee.

Objects: The main objects of the society should be:

(a) To improve the yield and the quality of sunn hemp.

(b) To sell the producers' (members' as well as non-members') sunn hemp at the highest possible price.

Regarding (a) the main items in this programme should be:

(i) *Procurement and distribution of good quality seed:* In certain tracts sunn hemp plants are harvested before the seeding stage. Seeds for sowing have, therefore, to be imported from other tracts. In such circumstances the quality of seeds available for sowing is generally poor. There is a high percentage of immature and damaged seeds. The weed seeds abound—among these the presence of seeds of *Ipomea* weed is particularly objectionable. Its vines entwine the sunn hemp plants and there is difficulty in harvesting as well as in the extraction and cleaning of fibre. A good portion of the *Ipomea* vines therefore, gets packed along with sunn hemp. It is generally reported that consumers abroad strongly object to the presence of *Ipomea* vines in sunn hemp. The cooperative societies can help the members in procuring healthy, viable and pure seed of such improved varieties as may have been evolved and approved by the Department of Agriculture.

(ii) *Popularizing better methods of preparation for market:* In the absence of any definite scientific findings regarding the best stage of harvesting and proper methods of retting and extraction of fibre to suit a particular locality, a beginning may be made by employing some trained retters from such contiguous localities as produce better and cleaner sunn hemp. Information on this point may be secured by the organizers of such societies from the sunn hemp inspection Staff, i.e. Chief Inspector, Sunn Hemp Grading at Shiupur (Benares) and the Inspectors, Sunn Hemp Grading at Calcutta, Vizianagram and Bombay.

Regarding (b) the main items are discussed below:

(i) *Assembling, grading and pooling:* The members should bring their sunn hemp to the premises of the Society, but in localities where direct marketing is not customary, it may probably be desirable in the beginning to collect the members' produce from their respective houses and gradually induce them to bring it themselves to the Society. This will create interest in the working of the Society apart from its educative value. Each member's sunn hemp should be weighed in his presence and if possible also cleaned and graded. The weight of each grade should also be recorded in his presence. Sunn hemp of each grade may then be pooled together (except the produce of such members as indicate that their hemp should be kept in stock for sale at some future date). The producer should be encouraged to clean and grade his produce with his own hands. A proper godown would be necessary for the storage of sunn hemp because of its inflammable nature. (This is one of the reasons why the producers sell it as quickly as possible). For

the same reason it would be desirable to insure the sunn hemp stocked.

Grading at different centres should be done on more or less uniform basis. For this purpose adoption of *Agmark* grades is suggested. This will do away with the necessity of cleaning and grading again by the balers. This grading by the Societies should be linked up with the *Agmark* Sunn Hemp Grading Scheme.

(ii) *Sale of graded sunn hemp:* When sufficiently large quantities are pooled, sale may be arranged by auction. The prospective buyers may be intimated about the date of the auction and the sellers may also be informed. In course of time, sufficient quantities of sunn hemp will begin to arrive and it may be possible to fix a day every week for these auctions. The highest bidder should be entitled to purchase the sunn hemp if the Managing Committee agrees to sell at the rate offered. Written contracts should be entered into and buyers other than those approved by the Managing Committee should be required to pay some advance money say 25 per cent of the value of the sunn hemp sold. Buyers should be required to take delivery within a specified period. The approved buyers may be given credit facilities for a short customary period, while with others cash down basis should be the rule. The account of each cultivator may be settled soon after the sale of the heaps containing his sunn hemp. It is believed that the sale of graded sunn hemp through the society will bring better prices to the producers. If a suitable portion of what is realized over and above the market rate (of unassorted sunn hemp) is distributed to the producers soon after the sale, it will provide a real incentive for them to market their produce through the Society. This will attract non-members also. Marketing charges to be deducted from the sale proceeds should also include labour charges of cleaning, grading, *kachcha* baling as also such other charges as can be easily allocated to each producer's lot. Other costs may be met from profits and if there be none, from the reserve fund.

Finance: Members should be able to get advances on the security of their stocks upto say 75 per cent of the market value. If necessary, provision for advancing of loans for cultivation expenses of the crop and loans on standing crops may also be made. To such members as are members of the affiliated credit societies, loans should be advanced through the credit societies. Attempts should be made to see that loans granted to members are utilized for the purpose for which they were advanced.

As membership fees and share money will not be enough for the working of the Society, necessary finances should be provided by the Central Cooperative Bank of the District in which the Society has its godowns. Deposits may also be accepted from members as well as non-members at reasonable rates.

Staff: As the successful working of the Society greatly depends upon its staff, special care should be taken in its recruitment. In the initial stages close official supervision will be necessary. As the marketing season of sunn hemp does not last for more than six months, it may be advisable to undertake marketing of some other produce also particularly during the off season. The sale of sunn hemp seeds and if possible the supply of producers' other requirements, e.g. manures, implements, etc. may be undertaken. This will make the working of the Society economical.

Financial position: The financial position of different societies will vary; it will depend on the amount of business handled, the rate of commission charged, the savings accruing from reduction in *dhalta* and the premia secured through grading, pooling and establishing a direct contact with balers. As an illustration, the financial position of a society if organized at Raja Talab (a market notorious for its refractive sunn hemp) is roughly indicated below.

If the Society deals with about 10,000 md. of sunn hemp (out of a total arrival of about 20,000 md.) valued at about Rs. 35,000, commission from buyers at the rate of Re. 1 per Rs. 100 will be Rs. 350. Deductions amount to about three seers per maund. Out of this it may be possible to retain 1 to 2 sr. per maund in the Society. The value of this sunn hemp will be Rs. 875 to Rs. 1,750. Besides these six pies per maund are levied from the seller as *vapsi* and *gowshala* to be made over to the buyer. It may be possible to retain this sum in the Society and thus make an income of about Rs. 300. The total income will thus be Rs. 1,525 to Rs. 2,400 per annum.

As regards expenditure, the pay of the manager at Rs. 100 per month, that of an accountant at Rs. 50 and two men at Rs. 30 each will amount to Rs. 2,520 per annum; rent may account for another Rs. 300; adding some miscellaneous charges the total expenditure may be about Rs. 3,000. It may be possible to reduce the expenditure debitable to sunn

hemp to about one half of this if other agricultural produce as also members' requirements are dealt with. The financial position discussed above relates only to the activity of the Society as a commission agent and excludes the share of the Society in the premia realized over and above the market rates. The real advantage to producers will be by way of better premium for better quality (including higher prices due to saving in the transport of excessive refraction), larger share in the consumer's rupee by the elimination of two classes of middlemen namely village merchants and balers' buying agents, correct weighment, fair dealings, easier finances and the improvement in quality that may be brought about by the supply of better seed and the demonstration of better methods of retting and extraction of fibre. If the producers reduce the stick content by five seers per maund the saving in transport charges from villages to Raja Talab and from there to Shiupur will amount to Rs. 625 on the produce passing through the Society. It is possible to reduce the stick content by 10 to 15 sr. per maund and thus get better prices (due to the saving on transport charges) to the extent of Rs. 1,250 to Rs. 1,875. The cost of cleaning and grading at Shiupur now-a-days comes to about three annas per maund of uncleaned sunn hemp. If the producers reduce the stick content by 10 sr. per maund it may be possible to get this work done at about half this rate at Raja Talab. This will mean a saving of about Rs. 1,200. Thus better value to the extent of about Rs. 2,450 can be realized simply by producing cleaner hemp (by reducing the present stick content of about 20 sr. per maund to 10 sr. per maund) and then later on by further cleaning and grading it in the Society's premises. It is hoped that the producers will ultimately market thoroughly cleaned (further cleaning of which may not be necessary even at the Society premises) and graded sunn hemp and will further save about Rs. 700.

Besides the above savings, better prices may be expected by having direct dealings with the balers. Based on general observations and a few actual instances, it is estimated that an increase of 4 to 8 as. per maund can be secured by selling direct to the balers. Adding to it the savings indicated in the last para a total increase of 8 to 12 as. per maund may be expected; the Society paying its own way. In addition to this it is hoped that the Society will be instrumental in improving the quality of fibre considerably and hence its export price. There appear, therefore, to be considerable potentialities in this direction.

LEAF VARIEGATION IN FRUIT TREES

AN irregular yellow mottling of fruit-tree leaves known as infectious leaf variegation has been noticeable again this year. This minor disease, which occurs principally on apples, varies in amount from year to year but does not spread in the orchard. It may dwarf the leaves slightly and make them susceptible to spray injury and may even appear in the fruit, but on the whole it does not seriously affect the tree.

Leaf variegation is fairly common in cherries also, particularly the variety St. Margaret. In cherries it appears more as a silver-grey mottling, and usually results in slight stunting of the branch or tree affected. It may occur also in other stone fruits and in pears.

There is no known cure for leaf variegation. It seems to be due to a virus which is spread by budding and grafting. Its spread therefore can be checked only by choosing scions from trees which have not shown any sign of variegation, but even this is not a sure way, as some varieties which do not show symptoms can transmit the disease to others.—*The Journal of the Department of Agriculture*, Victoria, April, 1946.

WAR AND THE PUNJAB AGRICULTURE

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THE war broke out in September, 1939, and lasted for about six years. During this period there has been a great rise in the prices of agricultural produce.

The object of this note is to see how the Punjab cultivator reacted to these big changes in prices.

Wholesale harvest prices

A study of the wholesale harvest prices of various agricultural commodities in the Punjab since 1938-39 shows that there was not much rise in the prices of *kharif* food grains during the first two years of war. The price of *desi* cotton, after rising from Rs. 4-9 in 1938-39 by Rs. 2 in the first year, came down by Rs. 1-5, i.e. to Rs. 5-4 per maund next year, the net rise being only as. 11 per maund over the 1938-39 price as compared with the corresponding figure of Rs. 1-8 in the case of American cotton, thus increasing the difference in the prices of the two types from about 23 to 36 per cent. The price of rice and *rabi* food grains, particularly wheat, showed slight appreciation. In the third year of war, particularly after the outbreak of hostilities with Japan, the prices began to rise rather sharply. Wheat price had, therefore, to be controlled first at Rs. 4-6 in December, 1941, and then at Rs. 5 in May, 1942. As the entry of Japan in the war stopped the import of Burma rice into this country and the export of *desi* cotton to Japan, the 'grow more food' and 'less *desi* cotton' campaigns were started in the spring of 1942 to meet this emergency.

During the third and fourth years of war, the prices of all products recorded sharp increases. In January, 1943, the price of wheat had to be decontrolled, since at the low price of Rs. 5 per maund, enough supplies were not flowing into the markets. Immediately after decontrol the price shot up to Rs. 11 per maund, but later on at the harvest time it steadied near about Rs. 10. The prices of rice and wheat, which are of all-India importance, rose to about three to four times the pre-war level; those of other *kharif* and *rabi* grains and oilseeds only two to three times. Cotton prices also increased to more than twice, but rise in the price of American cotton was greater than that of *desi* cotton. During 1943-44, while the prices of *kharif* food grains, oilseeds and cotton continued to increase, those of *rabi* food grains and *gur* somewhat declined. In the year 1944-45 the prices of *kharif* food grains and cotton declined, while those of *gur* and gram improved a little. Wheat, barley and oilseeds more or less maintained their previous level.

We have now to see how this general and comparative rise in the prices of agricultural products and the 'grow more food' campaign have affected crop production.

Effect on cropping

It has already been said that the appreciable rise in prices occurred only in the spring of 1942 and the 'grow more food' campaign was also started at that very time. One should not, therefore, expect much change in cropping until 1942-43, when the sown area increased by 2·7 million acres, as compared with that of the previous year as shown in Table I.

TABLE I

Area sown under kharif *and* rabi *crops, area failed and area matured in million acres*

		1939-40	1940-41	1941-42	1942-43	1943-44	1944-45
Total kharif crops	Irrigated	6·8	6·9	7·0	6·8	7·3	7·3
	Unirrigated	6·2	7·4	6·9	8·0	7·2	7·3
	Total	13·0	14·3	13·9	14·8	14·5	14·6
Total rabi crops	Irrigated	10·2	10·3	10·2	10·1	10·3	10·3
	Unirrigated	6·7	8·2	8·2	10·1	8·2	9·8
	Total	16·9	18·5	18·4	20·2	18·5	20·1
Total area sown	Irrigated	17·0	17·1	17·2	16·9	17·6	17·6
	Unirrigated	12·9	15·7	15·1	18·1	15·4	17·1
	Total	29·9	32·8	32·3	35·0	33·0	34·7
Total area of crops failed	Irrigated	0·8	0·8	0·6	0·7	0·6	0·8
	Unirrigated	4·8	4·4	4·4	2·6	3·2	3·1
	Total	5·6	5·2	5·0	3·3	3·8	3·9
Total area of crops matured	Irrigated	16·2	16·3	16·6	16·2	17·0	16·8
	Unirrigated	8·1	11·3	10·7	15·5	12·2	14·0
	Total	24·3	27·6	27·3	31·7	29·2	30·8

A close study of irrigated and unirrigated sowings shows that in 1942-43 both in *kharif* and *rabi* not only there was no increase in irrigated sowings but they were actually less by over 0·2 and 0·1 million acres respectively. Unirrigated sowings, however, increased by over a million acres in *kharif* and two million acres in *rabi*. A study of matured area, however, shows that there was an increase of 4·4 million acres, i.e. 1·7 million acres more than the total increased sowings. This is due to the fact that the area of crops failed was less by this much. The conclusion is, therefore, irresistible that the climatic conditions must be very favourable in 1942-43. A similar peak for sown area had been reached under equally favourable conditions in 1933-34.

The rainfall

During the year 1942-43, the rainfall in Ambala and Hissar was 57·91 in. and 22·25 in. respectively as against the normal rainfall of 31·55 in. and 15·98 in. at those places. At Lyallpur and Multan it was 15·78 in. and 9·99 in. respectively, which is a little more than two inches above the normal in each case, and in Jullundur and Rawalpindi it was somewhat below normal. In the year 1943-44, while rainfall in Lyallpur, and Jullundur was 17·98 in. and 27·77 in. respectively, i.e. above the normal, that in Ambala and Hissar was 28·47 in. and 12·9 in. respectively which is below the normal and in Rawalpindi near about the normal. The year 1943-44 was, therefore, generally poor in rainfall in comparison with 1942-43. The monsoon not being so favourable in 1943-44, the sown area came down by about two million acres in comparison with previous year. The *kharif* and *rabi* unirrigated areas came down by 0·8 million and 2 millions respectively, while irrigated *kharif* and *rabi* acreage rose by 0·52 and 0·22 million acres respectively. The area of crops failed also increased by about 0·5 million acres. In other words there was an increase of only 0·7 million in the total sown area in 1943-44 as compared with that of 1941-42. The following year (1944-45) was again favourable, though not quite as good as 1942-43. The sown area, therefore, increased by a little over 1½ million acres mostly due to the increase in unirrigated *rabi* area. The area of crops failed increased by about 0·1 million acres due to failure in the irrigated area but matured area increased by 1½ million acres due to increase in the unirrigated area, though it was still lower than that in 1942-43 by one million acres.

We will now see how cropping has been affected. As the number of crops is very large it is not possible to deal with each one of them separately. The discussion will, therefore, be restricted to important crops only or groups of crops.

Cereals and pulses

The total area in 1941-42 was 22,138,000 acres. During 1942-43, there was an increase of 3·35 million acres. Next year there was an increase of only 1·26 million acres as compared to 1941-42. During 1944-45 there was again an increase of 2·55 million acres. The chief increases in million acres as shown by various crops are given in Table II.

TABLE II

Increase (+) or decrease (−) in million acres of various crops

Increase over 1941-42	Gram	Bajra	Wheat	Pulses	Rice	Barley	Jowar	Maize	Other cereals	Total
1942-43	+ 1·37	+ 0·71	+ 0·45	+ 0·28	+ 0·21	+ 0·14	+ 0·12	+ 0·11	− 0·04	+ 3·35
1943-44	+ 0·64	− 0·02	− 0·02	+ 0·20	+ 0·36	− 0·04	+ 0·06	+ 0·14	− 0·06	+ 1·26
1944-45	+ 1·48	− 0·12	+ 0·42	+ 0·18	+ 0·37	+ 0·05	+ 0·11	+ 0·17	− 0·11	+ 2·55

It will be observed that in the favourable year there was an all round increase though more marked under gram, *bajra*, and pulses, which are mostly *barani* and wheat which is nearly half *barani*. The increase in rice area was partly due to extra water given for land reclamation. In 1943-44 this increase was more or less maintained in maize and pulses, rose still further in rice, reduced to less than half in case of gram, but was totally lost in *bajra*, wheat, barley and *jowar*. The year 1944-45 was again a favourable year specially for unirrigated *rabi*, though not quite so good as 1942-43. The area under gram increased

by 1·48 million acres and wheat by 0·42 million acres. There was also an increase in rice, *jowar* and maize, while the area under *bajra* and pulses went further down.

Cotton

The total area in 1941-42 was 2,801,000 acres. During 1942-43, it decreased by 0·481 and in 1943-44 by only 0·2 and in 1944-45 by 0·384 million acres as shown in Table III.

TABLE III

Decrease (—) in area under cotton

	(In million acres) Desi	American	Total decrease
1941-42	..	..	..
1942-43	— 0·509	+ 0·028	— 0·481
1943-44	— 0·48	+ 0·28	— 0·20
1944-45	— 0·535	+ 0·151	— 0·384

It will be seen that *desi* cotton decreased by 0·509 and American increased by 0·028 million resulting in a net decrease of 0·481 million acres in 1942-43, but in 1943-44 *desi* cotton decreased by 0·48 million acres and American increased by 0·28 million resulting in a net decrease of only 0·2 million acres. During 1944-45 *desi* cotton decreased by 0·535 million and American increased by 0·151 million acres resulting in a net decrease of 0·384 million acres. The reason for different behaviour of *desi* and American cotton lies in their comparative prices as already discussed.

Fodders

During 1941-42 the area under fodders was 4,983,000 acres. There was practically no change in it during 1942-43 but in the next two years there was an increase of 0·11 and 0·29 million acres respectively.

Oilseeds

During 1941-1942, the area was 1,057,000 acres. It fell by about 0·15 million in 1942-43 and further by 0·3 million next year, i.e. by 0·45 million acres in two years. The reduction occurred in *toria*, sarson and *taramira*—half in *toria* and half in the other two. Although the prices of *toria* and rapeseeds rose to about two and a half times in 1942-43 and to about three times in the following year, yet the area under cultivation contracted. During 1944-45 the area again increased to the level of that in 1942-43.

Other crops

So far we have accounted for 31·1 million acres out of 32·3 million acres sown. The balance of 1·2 million acres was occupied by sugarcane, vegetables, fruits, tobacco, spices and miscellaneous food and non-food crops. There has been no appreciable change in these. Sugarcane increased by 0·1 million acres in 1943-44 and 0·15 million acres in 1944-45. Vegetables decreased by 72,000 in 1942-43, and further by 65,000 in 1943-44. In 1944-45 there was an increase of 15,000 acres over the previous year. Spices, fruits and miscellaneous food crops increased by 41,000 acres in 1942-43, further by 1,000 acres in 1943-44 but decreased by 13,000 acres in 1944-45 in comparison with previous year.

As far as sown area is concerned, the above discussion may be summarized as below:

During 1942-43 there was an increase of 3·33 million acres under cereals and pulses. Of this 2·7 million acres was due to increased sown area, 0·48 million acres came from cotton mostly *desi* and 0·15 million from oilseeds. The increase in sown area was mostly due to favourable monsoon. A part of increase in rice area was due to extra water given for reclamation of *thur* lands. During 1943-44 there was an increase of only 1·26 million acres in cereals and pulses. Of this 0·6 million acres was due to increased sown area, 0·2 million acres came from cotton (*desi*) and 0·45 million from oilseeds.

In 1944-45 there was an increase of 2·53 million acres in cereals and pulses. Of this 0·384 million acres came from cotton (*desi*), 0·15 million acres from oilseeds and about 2 million acres were due to increased sown area owing to favourable monsoon.

Increase in production

We will now deal with the increase in production. The following statement (Table IV) gives the area, total production and yield per acre of all cereals and pulses for the last four years.

TABLE IV

Area, total production and yield per acre of cereals and pulses

Year	Area in thousand acres	Production in thousand tons	Yield per acre in tons
1941-42	22,138	6,469	0·292
1942-43	25,490	7,760	0·304
1943-44	23,399	6,432	0·275
1944-45	24,689	7,412	0·300

It will be observed that as compared with 1941-42 there was an increase of 3·35 million acres with an increased production of 1·3 million tons in 1942-43 against an increase of 1·26 million acres with a decrease in production of 37,000 tons in 1943-44 while in 1944-45 there was an increase of 2·55 million acres in area resulting in increased production of 943,000 tons. The data regarding the yield per acre give very interesting information. It will be seen that during 1941-42 and 1943-44 when the sowings were less, the yield per acre was also low, i.e. 0·29 and 0·27 tons per acre respectively, whereas in 1942-43 and 1944-45 when the sown area increased the yields were also higher, i.e. 0·3 tons per acre.

From the foregoing discussion of changes that have occurred in the cropping of the Punjab it is clear that there has been an increase in the area under food grain crops—cereals and pulses, during the last three years. This increase amounted to 3·35 million acres in 1942-43, 1·26 in 1943-44 and 2·55 in 1944-45. The favourable monsoons were responsible for high increase during 1942-43 and 1944-45. Owing to increased sowings more area was put under food grain crops. A portion of the increase under food crops, though a comparatively small one, is due to the replacement of cotton (*desi*) and oilseeds. This is more clearly shown in Table V.

TABLE V

Replacement of cotton and oilseeds in millions of acres

Year	Increased area under food grains over 1941-42	Area due to increased sowings	Cotton area replaced	Oilseeds area replaced
1941-42	..	..	..	..
1942-43	3·35	2·69	0·48	0·15
1943-44	1·26	0·61	0·20	0·43
1944-45	2·55	2·37	0·38	0·15

It will be observed from the above figures that favourable monsoon, which results in increased sowing and better yield per acre, is by far the most important factor for increased production of food grains. In the favourable years of 1942-43 and 1944-45 the increased sowing accounted for 80 and 93 per cent of the increased area under food grains as against only 48 per cent in 1943-44, which was not so favourable. The area got by replacement of cotton and oilseeds formed only 19 and 21 per cent of increased area under food grains in 1942-43 and 1944-45 respectively as against about 50 per cent during 1943-44. As regards the area obtained by the replacement of cotton and oilseeds, it appears that price factor is mainly responsible for it. For instance the price of oilseeds proportionately increased in 1943-44 resulting in increased area under them in 1944-45. This increase in prices of oilseeds has been maintained in 1944-45 and it may be expected that in 1945-46 the area under oilseeds may be maintained or even further increased. As regards cotton it has been already mentioned that *desi* cotton has been replaced by food grains due to its comparatively low price. During the present season (1945-46) the price of *desi* cotton has gone up appreciably (Rs. 17-8 per maund as against Rs. 20 of American) and has thus decreased the difference in the price of *desi* and American cottons. If this price level is maintained it is expected that the area under *desi* cotton will increase next year. It is, therefore, suggested that if increased food production is to be maintained as a long range policy the Government must strain every nerve to increase

(a) area under cultivation and food crops by developing irrigation resources, such as canals, wells, tanks, etc.

(b) yield per acre by improved methods of cultivation and utilizing all manurial resources such as human excreta, compost, green manuring, oil cakes, other artificial fertilizers, etc.

DAIRYING IN INDIA TOMORROW[1]

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INDIA possesses 200 million heads of cattle of which one-fifth are buffaloes. The zebu is used principally for draft purposes while the buffalo is maintained primarily for the production of milk. There are three facts which confirm this. Firstly, in most parts of the country, the male zebu is better cared for than the female, while the female buffalo calf is given better care than the male. Secondly whereas four out of five of our cattle are zebus, the buffaloes produce a little more than one-half of our milk. According to the *Report on the Marketing of Milk in India and Burma*, issued in 1943 by the Central Agricultural Marketing Department, Government of India, the average annual milk production of the buffalo is 1,529 lb., while that of the zebu cow is only 787 lb.; in each case these figures include about 300 lb. consumed by the calf. Thirdly, the buffalo not only produces more milk, but milk containing about 7 per cent of butterfat while only about 5 per cent is found in that of the zebu; furthermore, about 57 per cent of our milk is used for making *ghee* which is practically pure butterfat. The sole purpose of one sex of each of these animals, therefore, seems to be to assist in the reproduction of the species. Nature might have been a little more thoughtful and given us one species of which the male could be used for draft purposes and the female for producing milk. We have two species, however, either of which is potentially capable of serving both purposes to a greater extent than has yet been demonstrated.

Agreement with domesticated animals

Dr Sam Higginbottom has said that when man domesticates an animal species he enters into a bond whereby he will provide adequate feed, water and protection from enemies and diseases in return for a useful product or a useful service. It is my opinion that we have not only failed to fulfill this bond in our relationship with many of our domesticated animals, but have, by our methods of management, made it impossible for them to fulfill their part of the agreement. Denmark has, I believe, shown what can be expected in a short time if man does his part. The average annual production of milk per cow was increased in that country from 4,322 lb. to 7,260 lb. in 40 years. What can be done in India in increasing the average production of milk per cow, without sacrificing draft ability, is unknown. The results obtained in such places as Karnal and Patna with the Tharparkar breed and at Muttra with the Hariana indicates that yields of up to 5,000 to 6,000 lb. of milk or more a year do not necessarily reduce the draft ability of our animals.

Feed and production of milk

Dr N. D. Kehar of the Imperial Veterinary Research Institute and Dr Norman C. Wright of the Hannah Dairy Research Institute, Ayrshire, Scotland, give us figures which show that all the digestible nutrients available for our cattle is less than one-half enough to properly maintain them, exclusive of that required for growth, for reproduction or for the production of draft power or milk. Whereas a 500 lb. bovine requires 3·9 lb. of digestible nutrients daily, we can at best provide only 1·6 lb. They also show us that while such an animal requires 10 to 11 lb. of dry matter daily in its feed solely for maintenance, we can provide only 3·4 lb. at the present time. This is a sad state of affairs. Obviously we cannot expect our cows to produce more milk until they are much better fed.

It is frequently stated that village cows will give up to 50 per cent more milk on an average if properly fed and cared for. It would appear, therefore, that adequate feed alone would make it possible to increase our production of milk from 800 million to 1,200 million maunds yearly. Village zebu cows are reported to have produced as much as 6,000 lb. of milk, and village buffaloes as much as 10,110 lb. in about one year. It is known that the producing capacity of a cow is, on an average, approximately halfway between the producing capacity of its mother and the producing potentiality of its father. If cows which are capable of producing only 1,000 lb. of milk are bred to bulls with a producing potentiality of 6,000 lb., their daughters

[1] Broadcast from All-India Radio, Lucknow.

may be expected to produce an average of 3,500 lb. under the same environmental conditions. Our cows are inherently capable of producing more milk; their food supply, among other possible factors, prevents them from doing so. The same may be true of draft power as well.

More feed for cattle

Any reduction in the proportion of our land now used for producing grain and other crops for our people in order that greater quantities of feed might be provided for our cattle would only make matters worse than they now are. Better tillage practices, irrigation, the use of more fertilizer and the use of higher yielding varieties of existing or of completely new crops must be relied upon to give us the required feed for our cattle. The development of new farm implements or the redesigning of those now in use may, apart from better feeding, make the zebu a more useful draft animal. No one has yet undertaken to design implements particularly suited to the buffalo. Is it not reasonable to suspect that there are some possibilities in this? Why not use our cows for draft purposes? They do so in Europe and still get more milk than we do. Where horses are used as a beast of burden, mares which are used for breeding purposes, are regularly worked. The practice of using breeding bulls for hauling feed and manure about a dairy farm is considered a good management practice. We might investigate the possibility of working our cows, particularly those which produce very small quantities of milk and produce a calf only every 20 months or so. They might prove particularly useful in providing draft power at those seasons when it is most needed in the operations of the farm.

The number of male calves born equals the number of female calves. For breeding purposes, however, one bull can serve from 30 to 70 cows. Consequently, only a small proportion, that is one in thirty or so, of the male calves need be kept specifically for breeding purposes; the remainder may be used as bullocks. If those to be used for reproducing our milk stock were selected carefully on the basis of the production of their mothers, the average production of milk could, it would seem, be rapidly increased. That this can be done is indicated by the progress made in Denmark.

Cattle for tomorrow

Our only dependable source of cattle for tomorrow is those we have today. If we are to provide the milk stock we will need in the new India, we must provide more and better feed for them and we must control their breeding. The control of diseases is by no means unimportant because it is not discussed here. It will play an even greater part in the future than it has in the past, and it has been extremely important so far. If we are to ignore the needs of our cattle, allow them to find their own feed—if they can, provide them no special protection against diseases, and allow them to breed in their own way, we cannot justify their domestication upon which the economy of our country so greatly depends. It is estimated, for example, that the market value of the milk produced each year is roughly equal to that of all rice, or three or four times that of all wheat. Dr Wright, who gives us these estimates, states also that the value of cattle labour is about one-fourth of the total for all agricultural income.

Increase in milk production and decrease in cost

According to those who study human nutritional needs, each person should have 15 to 20 oz. of whole milk or its equivalent in the form of milk products daily. We now produce only about five to six ounces or one-third enough. The average farm cow in England or America produces from 4,800 to 5,500 lb. of milk each year. Surely it is not unreasonable to set as our goal for the India of to-morrow the production of three times the milk we now produce. This would give every person 16 to 17 oz. a day; it would involve a yield of 2,500 lb. a year by our zebu cows and 4,500 lb. by our buffalo cows. The cost of producing this milk cannot possibly be as high as that we now produce. If higher yielding fodder and grain crops are grown, feed costs will certainly be less than they now are; if higher producing cows are developed, a proportionately lower cost per maund of milk for maintaining the bodies of the producing animals will result; if much more milk is handled by distributing and processing establishments, surely the costs involved will be reduced.

Distribution of milk

One reason for the present high cost of distributing milk is the fact that the consumer

is not equipped to prevent the spoilage of milk without repeatedly boiling it, which is detrimental to its food value and to its palatability. It is necessary, therefore, that deliveries be made twice a day instead of only once. This practically doubles the expenses for labour and the equipment involved in transporting milk. If it were possible for the consumer to own a small household refrigerator in which to keep perishable foods, the cost of distributing milk might be only a fraction of what it now is. Incidentally, if milk were on hand in the home at all times more of it would be consumed.

Milk produced within our urban areas is expensive mainly because of the cost of the fodder consumed by the producing animals. Fodder purchased at the rates prevailing in the city bazaar will constitute 30 to 50 per cent of the cost of the milk. Such bazaar rates are commonly twice as high as the actual cost of producing that fodder in the village areas, sometimes more. If those cows now maintained in our cities were moved to rural areas where fodder is less expensive, not only would milk costs go down but our cities would be more healthful. There are many milk producers living just outside our cities who handle very small quantities of milk upon which they depend for a livelihood. One may commonly see a man or a woman carrying a small head load of milk from distances as great as three or four miles. The return trip requires as much as four hours. If the trip is made twice a day, no time is left, after caring for the producing animals, in which the person may increase his or her income from other sources. Either the milk must sell at a price sufficiently high to provide that person adequate income or it is not provided.

Because the customer is unable to keep milk in his home it must be delivered just at the time it is required for the morning or evening meal. Since most people have their meals at about the same time there is only a small period, perhaps two hours at the most, in the morning and in the evening when most of the milk must be delivered. The small producer finds that he cannot satisfactorily handle a quantity of milk that requires more than that short time to deliver. Consequently he produces only that much, perhaps a maund or two a day. The dairy which distributes large quantities of milk commonly finds it necessary for this same reason, to hire one delivery man for every two maunds of milk handled daily. The handling of larger volumes on each trip made by the distributor and the making of fewer trips would bring about a noticeable reduction in the costs involved.

There are many other points that could be mentioned. Two of these are the selling of milk through retail shops from which the customers must take delivery themselves, and the transportation of milk from the rural producing areas to the markets by lorries, thereby increasing the amount of milk handled per man. Apart from certain countries where the value of milk as a human food is unknown or unrecognized, I know of no greater promise of development in dairy farming and the dairy industry than in India tomorrow.

COVER ILLUSTRATION

The cover illustration depicts a scene of harvesting in South India. Photo by Mrs. Stan Harding. (*Courtesy of Bureau of Public Information, Government of India*).

IMPORTED GRAIN : A WARNING

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WITH a view to relieve distress threatened by famine and avert disaster, large quantities of rice, wheat, maize and millets have been and are being imported into India. Before export, rice is processed by the removal of husk so that it is rendered useless as seed. That, however, is not the case with the other grains. As there is a likelihood of scarcity of cereal seed due to its utilization as food, it is probable that some of the imported cereals may be used as seed by the farmers.

Seed-borne parasites

Several diseases of wheat, maize and millets due to fungi and bacteria are seed-borne and some of those parasites do not occur in India at present. It is clearly not possible to treat the thousands of tons of cereals that may enter the country within the next few months; in any case most of it will be consumed as food. But the farmers may feel tempted to use a small quantity for seed. Using such grain which may carry some seed-borne parasite is very hazardous and every means must be adopted to prevent it. By means of propaganda such as extensive distribution of leaflets warning against the use of imported wheat, maize or any other millet for seed, in the languages of the respective provinces, the district staff of the provincial and State Departments of Agriculture can render much help.

Some of the important diseases of the above cereals that are seed-borne are listed below :

Wheat

Bacterium atrofaciens McCull. Basal glume rot
Bacterium cerealinum (Gent.) Elliot, Bacteriosis
Bacterium translucens var. *undulosum* Smith et al. Black chaff
Calonectria graminicola (Berk. & Br.) Wr.
Dilophospora alopecuri Fr.
Fusarium culmorum (Smith) Sacc. Seed and seedling blight
Fusarium nivale Ces. Foot-rot and seedling blight
Fusarium subulatum App. & Wr. Head blight
Gibberella zeae (Schw.) Petch = *G. saubinetti* (Mont.) Sacc. Scab.
Ophiobolus graminis Sacc. Take all
Sclerospora macrospora Sacc. Downy mildew
Septoria nodorum Berk. Glume rot
Stemphylium parasiticum (Thuem.) Elliot
**Tilletia caries* (DC.) Tul. Bunt
**Tilletia foetida* (Wallr.) Liro, Bunt
**Urocystis tritici* Koern. Flag smut
**Ustilago tritici* (Pers.) Rostr. Loose smut

Maize

Bacterium stewartii EFS. Bacterial wilt
Nigrospora oryzae (Berk. & Br.) Pet. Dry rot
Botrytis cinerea Pers. Gray mould
Cephalosporium acremonium Corda, Black bundle disease
**Colletotrichum graminicolum* (Ces.) Wils.
Diplodia frumenti E. & E. Ear rot
Diplodia macrospora Earle, Grey ear-mould
Diplodia zeae (Schw.) Lev. Ear-rot and seedling blight
**Fusarium moniliforme* Sheldon, root-rot
**Gibberella moniliforme* (Sheld.) Wineland
Gibberella zeae (Schw.) Petch. Ear rot, seedling blight
**Physoderma maydis* (Miyake) Miyake, Brown-spot
**Sclerospora philippinensis* Weston, Downy mildew
**Sphacelotheca reiliana* (Kuehn) Clinton, Head smut

MILLETS (*Panicum, Setaria, Chaetochloa*)
Bacterium panici Elliot, stripe disease
Phoma sp.
**Sclerospora graminicola* (Sacc.) Schroet. Downy mildew
**Ustilago crameri* Koern. Head smut
**Sphacelotheca destruens* (Schw.) Stevenson & Johnson, [*Ustilago panici-miliacei* (Pers.) Wint.] Head smut

India is lucky that some of the fungi mentioned above do not occur here. *Opiobolus graminis* for example causes the dreaded disease of wheat known to the Australian, Canadian and New Zealand farmers as '*take all*'. The losses it causes are enormous and in some seasons are stated to be more than those caused by all the rest of the wheat diseases

* These occur in India

put together. The fungi marked with an asterisk occur in India but that does not mean that they should not be kept out of the country. In fungi there are races which are not distinguishable on morphological grounds but which vary in the degree of parasitism they possess. For example, loose smut due to *Ustilago tritici* is common in several wheat growing tracts of India and it is now known that there are two parasitic races of it. This is an internally seed-borne disease and other races of it may be imported into India with imported wheat, which do not occur in India and which may attack our wheat varieties that are immune or highly resistant to our races.

Preventing the use of imported grain as seed appears therefore to be the only feasible way of keeping out these diseases.

EXPLAINS HOW VIRUS DISEASES ARE SPREAD

DISEASES of plants caused by viruses are widespread in nature, occurring in most species of plants. There are, for example, mosaic and ring spot of dahlia, break of tulip, mosaic of lilies, mosaic of lettuce, beans, celery and many other plants. The mosaic diseases, says G. H. Berkeley, Officer in charge of the Dominion Laboratory of Plant Pathology, St. Catharines, Ont., have one symptom in common, namely, a mottling of the leaves in various shades of green and yellow showing in some plants in rings, flecks, streaks or patches. In other cases, leaves are curled or distorted, such as in the leaf curl of raspberries. In virus diseases, also, spraying is of little value, because the ultra-microscopic virus which causes the disease is confined within the plant, where sprays cannot touch it.

In nature, these diseases are spread from plant to plant by insects, especially aphids, leaf hoppers, and certain mites. The infective principle is present throughout the plant and is carried over in cuttings, corms and bulbs. Some of the diseases are transmitted even through seeds from infected plants. A plant once infected with a virus never recovers, and, because such plants may act as sources of spreading the disease to nearby healthy plants, they should be pulled up and destroyed. Control consists in maintaining a healthy source of seeds, corms, bulbs, or cuttings and destroying infected plants without delay.—*Canadian Note.*

TWO YEARS OF TOWN REFUSE COMPOSTING WORK IN INDIA

THE All India Scheme for converting town refuse into manure, sponsored by the Imperial Council of Agricultural Research and financed by a special grant from the Government of India, was initiated on 1 August, 1943, and the results of the first two years' working of the Scheme are now available for a critical appraisal of the possibilities and limitations of work in this direction.

The above Scheme aimed at creating in all provinces and States a set of specialist staff (Biochemists and Assistant Biochemists) who were trained in the Bangalore Process of Compost-making and were employed in starting compost production work at various municipal centres in the country. The training of provincial and State Biochemists by the Chief Biochemist and later on of the Assistant Biochemists in different areas by the regional Biochemists concerned, took the best part of the first year; and the training of sanitary inspectors and actual production work at municipal depots could be carried out on a systematic basis only during the second year of the Scheme starting from 1 August, 1944.

The results obtained during the year ending 31 July, 1945, show that the Scheme has yielded successful results, which have outstripped the original targets fixed for it. Nearly 469 municipal centres were trained in the new Process all over the country, as against a target of 240 centres originally fixed for the Scheme. Out of the above 436 centres, 317 have already started preparation of manure. Up to the end of July, 1945, over 13·8 million c.ft. (276,000 tons) of compost were prepared, out of which about 6·3 million c. ft. became ready for distribution during the *kharif* season, 1945. As a result of active propaganda by the provincial and State Departments of Agriculture, backed up by the grant of a subsidy from the Government of India, at the rate of 12 as. per 50 c. ft. of manure put on the land, it was found possible to distribute over 5·3 million cubic feet of manure, representing nearly 84 per cent of the total quantity of compost that had matured for sale before 31 July, 1945.

Considerable difficulties had, no doubt, to be faced both on the production and on the distribution sides. In the absence of any legal enforcement compelling municipalities to convert their waste materials into manure, the cooperation of municipalities had to be secured by persuasion and by promise of better economic returns, in addition to arguments of national welfare and the need to grow more food. On the distribution side, great difficulty was felt in overcoming the prejudice based on sentiment which existed in most parts of the country against the use of manure prepared from town-refuse and night-soil. Even visual demonstrations of the innocuous nature and good appearance of the final compost and its highly beneficial action on crops, made only slow headway. It stands to the credit of the regional Biochemists and their staffs that they were able to overcome the above difficulties and to show results in excess of the targets fixed for the Scheme. It may now be said that next to China, India is producing the largest quantity of manure from its urban wastes.

Some areas like Bihar, Sind, Orissa and Bengal have had, no doubt, more difficulties than other in overcoming local prejudice, but even in these areas a considerable amount of propaganda and initial spade work has been carried out. Farmers who have once tested the manure and been satisfied with its appearance and high manurial value, have become strong adherents to its use and have converted their neighbours to their views. Municipalities, on their part, have been quite satisfied with the hygienics of compost-making; and Health officers who have made repeated visits to compost depots have certified to the absence of any fly-nuisance at the depots and to the marked improvements which the introduction of the compost system had brought about in the sanitary features of refuse disposal.

The results achieved during the last two years show that the Scheme has got a successful future before it. Already, most provincial and State Governments have made the programme of town-refuse composting an integral part of their departmental activities, and are planning to expand the purview of their Biochemists, so as to include allied fields of compost-making, such as the better utilization of village wastes and the introduction of

improved methods of farmyard manure preparation. The immense scope that exists for developing work in this direction, has already been dealt with in a previous issue of this Journal[1].—C.N.A.

ANTI-MALARIAL SPRAYING OPERATIONS[2]

At the request of the Anti-Malaria Institute authorities, Delhi, the Second Entomologist and Assistant Economic Botanist, Imperial Agricultural Research Institute, New Delhi, visited Azadpur, Timarpur and Jumna bridge areas to study the effect of D.D.T. spray on various crops and crop pests.

The Medical Directorate, General Headquarters in collaboration with Anti-Malaria Institute had carried out aerial sprays of 5 per cent D.D.T. solution in kerosine in Timarpur and Jumna Bridge areas about 18 August, 1945, and had found that the vegetation in the area was considerably scorched. On examination it was found that wherever the spray had descended on the leaves, chlorophyll and other colouring substances appeared to have been destroyed leaving a translucent patch. The damage to the foliage appeared to be proportional to the intensity of the spray descending on it. The damage was more marked on tender leaves of cucurbits and spinach, less so on *Hibiscus* and maize and on sugarcane, brinjals, and wild grasses. It was emphasized that burning of leaves need not be attributed to D.D.T., as pure kerosine alone was well known to have burning effect on green foliage. Some of the recent literature on dilute emulsions of D.D.T. in kerosine on pine oil for spraying on green vegetation (*J. Econ. Ent.* **37**, 123 and *R.A.E.* **32**, 34, *etc.*) was brought to their notice.

Among the dead insects noticed on sprayed crops were adults of *Myllocerus maculosus* and *Plutella maculipennis*, and nymphs and adults of jassids and aphids.

On 22 August spraying of 5 per cent D.D.T. emulsion (and not solution in pure kerosine) was carried out from air in Azadpur area. The formula used was :

D.D.T.	..	25	parts
Toluene	..	33·35	„
Turpentine	..	33·35	„
Rectified spirit	..	4·9	„
Dry soap	..	2·8	„
Water	..	0·6	„

One part of this stock solution was diluted with four parts of water before use. Some of the common crop pests, viz. larvae and moths of *Earias* sp., adults and nymphs of jassids, eggs of a pentatomid bug, larvae of *Sylepta derogata*, etc. were exposed in trays and brought to the laboratory after the spraying operation. All these were alive after 48 hours, excepting *Earias* moths which died overnight. The spraying seemed to be high, but it was not uniformly distributed and it was obvious that large strips of land were being left unsprayed while others were possibly sprayed more than once. The mosquito larvae in a large pond of water which had received a thorough spray were cent per cent killed.

This area was examined again on 25 August and it was found that no injury had been caused to foliage. There were white spots of the mixture varying from fine spray to thick deposit in some cases. But even the latter did not cause any scorching or burning of leaves. Some of the spray mixture was brought to the Institute and tried on cotton, sugarcane, *Luffa*, castor and brinjal leaves and found to be harmless to foliage.

On 30 August, the Azadpur and Timarpur fields were again examined. There was no scorching or burning of any kind in Azadpur area where dilute emulsion had been used. Only in a few cases where heavier drops of emulsion had deposited thick white D.D.T. spots, the chlorophyll had somewhat faded. In Timarpur area where D.D.T. in kerosine had been sprayed, the dead spots on leaves could be seen as usual, but now they were proportionately much less, since new foliage had come up. In severe cases the affected leaves showed signs of drooping and drying of tips.

As a result of the obvious damage due to pure kerosine, the authorities were advised to discontinue the spraying of D.D.T. in kerosine over cropped areas and use Toluene-turpentine emulsion of D.D.T. in water which was harmless to vegetation.—I.A.R.I.

[1] *Indian Farming* Vol. VI, No. 6, pp. 104-108

[2] Report on the visits of Dr Tashkir Ahmad, Second Entomologist and Dr Chinoy, Second Assistant Economic Botanist, Imperial Agricultural Research Institute, to Anti-Malarial D.D.T. spraying operations around Delhi

What would you like to know?

Enquiries regarding agriculture and animal husbandry should be addressed to the Directors of Agriculture and Veterinary Services in provinces and states. This section is reserved for replies to selected letters in cases where it seems that the information may be of general interest.

Q. I am very much interested in the cultivation and development of papaya cultivation and its products of medicinal value. In this connection could you tell me the process of extracting milk from the papaya fruit and suggest some books on the subject? Could you also let me know where I may get crude papain analyzed? (S.A.W.R.N. & Co.)

A. Some work on the preparation of papain has been done in the United Provinces and a good deal of information seems to have been collected in regard to the extraction of juice, preparation of papain, marketing of papain, etc. A reference to the Director of Agriculture, United Provinces, may be made direct.

An article entitled 'The culture of Papain' appearing in the February 1941 issue of *Indian Farming* contains names of some literature on the subject. There is another good publication on papaya products by J. L. Heid and A. L. Curl, U.S. Citrus Products Station, Winter Haven, Florida, published in October, 1944, in the *Fruit Journal and American Food Manufacturers.* This publication gives very good information on different kinds of products like conserves, *chutney*, pickle, butter, jam, marmalade, ketchup, canned blends of papaya pulp and citrus juices, canned slices or cubes of ripe papaya, candied papaya, and dehydrated papaya which can be made from this fruit.

If a sample of papain is supplied to the Director, Indian Institute of Fruit Technology, Lyallpur (Punjab), it could be analyzed with regard to its enzymatic activities.—(G.L.)

Q. Will you please tell me if there are any standard books on Fruit Culture? Is it possible to obtain some popular literature on the subject? (D.K.L.)

A. As regards popular literature on the subject you may address the Directors of Agriculture of various provinces to send you the bulletins and leaflets dealing with the cultivation of fruits. A list of some standard books on the subject also showing wherefrom these can be had is given below:

(1) WICKSON	*California Fruits* (1) Pacific Rural Press, San Francisco. (2) D. B. Taraporevala & Sons, Hornby Road, Bombay.
(2) WILSON	*Manual of Tropical and Sub-Tropical Fruits* (1) D. B. Taraporevala & Sons, Hornby Road, Bombay. (2) MacMillan & Co. Ltd., Fifth Avenue, New York.
(3) FIRMINGER	*Manual of Fruit Gardening* (1) D. B. Taraporevala & Sons, Hornby Road, Bombay. (2) Thacker Spink & Co., Calcutta.
(4) W. H. CHANDLER	*Fruit Growing* (1) Hougton Miffin Company, New York. (2) D. B. Taraporevala & Sons, Hornby Road, Bombay.
(5) V. R. GARDNER, F. C. BRADFORD & H. D. HOOKER	*The Fundamentals of Fruit Production* McGraw Hill Book Co., 370, 7th Ave, New York.
(6) GANDHI	*Grape Culture in Western India* Government Printing and Stationery, Bombay.
(7) V. P. HODRICK	*Manual of American Grape-Growing* (1) MacMillan & Co., 64-66V, Ave, New York. (2) D. B. Taraporevala & Sons, Hornby Road, Bombay.
(8) H. P. GOULD	*Peach Growing* (1) MacMillan & Co., Ltd., St. Martin Street, London. (2) D. B. Taraporevala & Sons, Hornby Road, Bombay.
(9) F. A. WAUGH	*The American Apple Orchard* D. B. Taraporevala & Sons, Hornby Road, Bombay.

What's doing in All-India

THE PUNJAB

RAI BAHADUR B. N. HANDA, B.Sc., M.R.C.V.S.
Deputy Director (Livestock Breeding), Punjab

TAKING into consideration the entire supply position of cattle in the Punjab, the Punjab Government have decided that this Province should export cattle of all descriptions to the extent of about one lac or even one lac and five thousand in a year. The following monthly quotas of milch cattle for various provinces are fixed :

Bombay	..	1200	
Bengal	..	600	
United Provinces	..	400	
N.W.F.P.	..	75	
Delhi	..	40	
Bihar and Orissa	..	50	
Madras	..	50	
Central Provinces	..	40	
		2,455	per month or
		29,460	per annum
Add 1800 to meet miscellaneous demands		1,800	
Add 90 per cent for calves on foot		28,134	
Add estimated demand for military requirements		4,304	
Total		63,698	

It has also been estimated by the Punjab Government that 2,500 animals would be required for slaughter by the two Military Commands and 25,000 animals by the neighbouring provinces for the same purpose. In addition to these they have sanctioned an export of 5,000 stud bulls, bullocks and plough cattle. So the total of slaughter animals, bulls and bullocks for the provinces would be 32,500.

On the above basis the total export of milch as well as other animals, both bovine and buffaloes, fixed by the Punjab Government would come to 96,198. The Director, Veterinary Services, Punjab, has, however, been authorized to regulate the export of slaughter cattle subject to a maximum of one lac or one lac and five thousand in all of milch and other animals.

The quota of milch cattle fixed for the various provinces is both for buffaloes and cows.

The Government would check the figures for actual exports at the end of six months and see if any re-adjustment is desirable.

The export of milch and breeding cattle is permitted from the Punjab only if the Governments of the importing provinces or States give an assurance that the cattle exported from this province would be maintained when they go dry and would not be sold or slaughtered so long they are fit for work or breeding. The object of imposing this condition is to check the drain on the cattle wealth of this province and also to impress upon the importing provinces and States to conserve the breeding and the working stock by prohibiting the slaughter of useful cattle.

Artificial insemination in cattle

The Imperial Veterinary Research Institute, Mukteswer, United Provinces, has deputed a special staff to this province, with headquarters at Montgomery, under their Artificial Insemination Development Scheme to perfect the practice of artificial insemination in cattle in this province. The method of collecting semen, employed by the officer incharge of the operations, is the artificial vagina. This method is proving most satisfactory as the whole ejaculate, free from vaginal secretions and uncontaminated by extraneous matter, is being collected. Semen collected is being used immediately and is never stored. Also insemination is being practised while the cow is in oestrus. From each bull only two ejaculations are being taken a week.

It has also been noticed at this centre that there is great variation in the viability of sperm samples from different bulls and also from the same bull at different times. The best indication of high quality semen and its suitability is good motility after collection.

The villagers have evidently welcomed this method of serving their cows as they turn out

in fairly large numbers with their animals on the day when this operation is to be conducted. The announcement is made by the drum-beaters who are sent round to the villages well in time.

It is considered that as the number of good bulls, particularly proven ones, capable of transmitting increased milking qualities to their daughters is limited, the artificial insemination work has got a great scope in this province.

It is proposed under the post-war development plan that, with proper organization and trained staff, the services of the best and chosen bulls should be made available to a large number of dairy farmers and ordinary cultivators, who chiefly for economic reasons, are not at present in a position to keep and maintain good 'sires'.

Cattle improvement scheme (Sahiwal cattle)

A Scheme for Herd Book Pedigree Registration and Milk Recording of the Sahiwal Breed is in force in the Punjab from the 1 April, 1943. The public has now begun to feel the comparative standard of the produce of animals registered under the Scheme. This is evident from the fact that the livestock registered under the scheme and their produce bring better prices to their owners. A cow No. F.J.144 yielding 3,994 lb. per lactation period was sold for Rs. 560 and its progeny No. F.J.250 out of sire J.155/4·4 when it was only two years of age was offered Rs. 300 but the owner refused to sell it. The most notable examples are the Cattle Herd Book Cows No. F.J.39 and F.J.148 whose owners were offered Rs. 1,000 and Rs. 920 respectively, which they did not accept. Their maximum milk yield per diem was 15 and 24 lb. respectively.

Regional cattle show, Dajal

The 1946 Regional Cattle Show for the Bhagnari breed (Dajal) was held at Dajal, in the home of the breed, on 1 and 2 February, 1946. The milk competition was its special feature. The average milk yield per diem of the first three selected cows was as follows:

	Quantity of milk yield lb.	oz.	Lactation number	Prize awarded
1. Lal s/o Khuda Bux, Village Isran, Tehsil Jampur, Distt. D.G. Khan	33	4	Third	First Rs. 35
2. Ghulam Nazak, s/o Karim Bux Machi, Village Dajal, Distt. D.G. Khan	25	15	Fourth	Second Rs. 20
3. Mohd. Khan, Sub-Postmaster, Village Dajal, Distt. D. G. Khan	23	12	First	Third Rs. 10

The Dajal breed, which is extensively bred in the Dera Ghazi Khan district of the Punjab is an off-shoot of the Bhagnari breed. The characteristics of these cattle are very similar to those of the Bhagnari breed and large numbers are now sold to other parts of the Punjab for draught purposes. The cows are reputed to be fair milkers and selected animals give quite good yields. These cows should be regarded as quite good for the dairies, not unlike the Hariana, and the breed is definitely a dual purpose one.

Cattle and horse fairs

The following information of interest to other provinces has been furnished by the local bodies of this province regarding some of the cattle and horse fairs held by them in the last six months of the year 1945.

I. Autumn cattle fair, Hissar
(16-9-1945 to 27-9-1945)

Animals: Mainly Hissar bullocks, camels and Hissar young calves

Animals brought for sale	13,555; last year	16,442
Animals sold	6,537; last year	4,062
Sale amount	Rs. 11,74,301; last year	Rs. 10,31,810

Highest prices

Calves	Rs. 390
Bullocks	Rs. 945
Camels	Rs. 735
Female buffalo	Rs. 765

Amount of fees realized by the District Board on the sale of cattle, etc.	Rs. 36,696–14–6
The same for last year	Rs. 32,244– 1–0

II. Bahadurgarh cattle fair
(28-7-1945 to 4-8-1945)

Animals: Mainly Hissar cows, Murrah buffaloes and Hissar male youngstock.

Animals brought for sale	1,88,787; last year	27,109
Animals sold	2,008; last year	2,762
Sale amount	Rs. 3,66,381; last year	Rs. 6,53,264

Highest prices

Bullocks	Rs. 840
Buffalo cow	Rs. 800

Amount of fees realized by the District Board, Rohtak on the sale of cattle, etc.	Rs. 11,574-12-6
The same for last year	Rs. 20,586-13-0

III. Autumn cattle fair, Fatehabad
(9-9-1945 to 15-9-1945)

Animals : Mainly bullocks, buffaloes and camels

Animals brought for sale	3,525 ; last year	1,737
Animals sold	658 ; last year	739
Sale amount	Rs. 59,461 ; last year	Rs. 1,04,528

Highest prices

Bullocks	Rs. 650
Calves	Rs. 200
Female buffaloes	Rs. 500
Camels	Rs. 900

Amount of fees realized by the District Board, Hissar on the sale of cattle, etc.	Rs. 1,858- 2-6
The same for last year	Rs. 3,266-13-0

IV. Cattle fair, Jehazgarh
(27-9-1945 to 6-10-1945)

Animals : Bullocks and the young bulls

Animals brought for sale	52,267 ; last year	89,886
Animals sold	5,279 ; last year	8,940
Sale amount	Rs. 8,34,373 ; last year	Rs. 21,12,033

Highest prices

Bullocks	Rs. 1,000
Bull	Rs. 825

Amount of fees realized by the District Board, Rohtak, on the sale of cattle, etc.	Rs. 26,404- 1-6
The same for last year	Rs. 66,559-12-6

It will be observed that there has been an all-round decrease in the income derived by the District Boards from the cattle fairs. This is due to the restrictions on the movement of cattle between the British Punjab and the adjoining States and the consequent lower attendance and sale.

ASSAM

RAO SAHIB V. R. GOPALAKRISHNAN
Veterinary Investigation Officer, Assam, Gauhati

SCHEMES for post-war development of nation-building departments have been engaging the attention of the Government of Assam for a few years past. In March, 1945, the Provincial Post-War Reconstruction Committee, presided over by the Hon'ble Prime Minister Maulavi Saiyed Sir Muhammad Saadulla, considered various schemes and indicated the expenditure to be shared by different departments. Animal husbandry and veterinary schemes have received due consideration. Schemes for the first post-war quinquennium have been drawn up and are expected to be financed under two catergories—schemes of first priority and those of second priority. As the war is over, peace-time development would be speeded up.

Development schemes

Important developments are contemplated to strengthen and expand the animal husbandry organization. It may be mentioned in this connection that Assam had to undergo various difficulties during the war, having been a war-front for India. High price of cattle due to their reduction in number, scarcity of milk, decrease in goat and sheep population, abnormal price of fowl and egg, etc. were observed. Hence the present schemes have been so prepared and planned as to effect an all-round improvement. They may be classified under three sub-heads :

(i) Improvement in livestock production
(ii) Fodder and grazing improvement
(iii) Greater facility for treatment and control of animal diseases

Breeding

Assam is a land of forests and extensive grazing areas. Indigenous cattle breeding centres of private owners are common in such grazing areas or 'reserves' and these centres are locally called *khutis*. Improvement in cattle breeding in grazing 'reserves' is an important scheme in this province. It provides for part of the provincial requirements of improved breeding bulls, draught and milch cattle and increase in the production of milk. Each centre in the 'reserves' forms a Government *khuti* with a veterinary dispensary. A net-work of such centres in the grazing 'reserves' provides an easy and rapid method of improving the livestock of the province.

A cattle breeding scheme through subsidized, selected, registered breeders is contemplated. Suitable owners will be registered and provided all facilities for the improvement of their stock through the supply of improved breeding bulls and cows at concession rates. It is felt that if cattle improvement is in the first instance

primarily delegated to the larger cattle owners who will be capable of effecting improvement, quicker results will be obtained as it will be possible to get improved young stock from these owners for wider distribution.

Buffaloes play an important role in providing milk and milk products to most of the towns of the province apart from their use as plough animals. As no work has so far been done on buffalo-breeding in Assam, a scheme for starting a full-fledged buffalo-breeding station has been prepared.

A scheme for goat and sheep breeding is proposed to intensify breeding work in some of the Government farms so that more animals of superior quality may be available to the public. Goat and sheep can supplement our milk supply and provide meat. These animals can become the poor man's cow.

Poultry population of Assam has been considerably depleted due to the war and therefore the urgency for increased production of improved birds is keenly felt. A scheme for breeding poultry (fowls and ducks) in the Government farms has been drawn up.

Fodder and grazing

Greater attention to the welfare of cattle and particularly to cattle nutrition is essential to bring about a general improvement in milk-yield, working capacity and productivity. Cattle in Assam are largely dependent on grazing as considerable areas of grazing lands are available. But cultivation of fodder crops is practically non-existent.

The Fodder and Grazing Improvement Scheme provides for measures for improvement of grazing lands and for introduction of fodder crops including grasses. It is proposed to introduce rotational grazing, improvement of pasture, restriction of the number of cattle per area, distribution of improved grasses, etc. in grazing 'reserves'. Moreover, a survey of pasture lands and a study of different rations will be undertaken to find out zonal scales of ration which the average cultivator can adopt.

Control of cattle disease

Schemes have been designed to improve and increase the existing facilities for the control of contagious diseases and for treatment of other ailments. To reduce the high percentage of cattle mortality due to rinderpest, extensive immunization of cattle with goat tissue vaccine is necessary. A Provincial Veterinary Vaccine Depot is to be started at an early date for the manufacture and supply of vaccine regularly and adequately to field workers.

Larger number of veterinary hospitals and dispensaries will be opened to give more medical aid to rural and urban areas.

With the object of preservation of productive cattle and young stock, a scheme has been prepared in which animals will be checked and supervised before being passed for slaughter. This scheme is necessary and beneficial as the existing stocks of draught and milch cattle have been reduced due to large increase in the slaughter of livestock during the war.

Expansion and reorganization of district staff, higher training for the technical personnel and better equipment of laboratories for undertaking research work, have been provided for in respective schemes.

Finally, a scheme for the control of bovine contagious pleuro-pneumonia—a disease that ranks second only to rinderpest in the list of major diseases of cattle in India—has been sanctioned and will be partly financed by the Imperial Council of Agricultural Research with effect from April, 1946. The control of this disease in the Brahmaputra Valley of Assam, where it is known to exist, will help much to reduce and check the cattle mortality in the affected localities and also to prevent the spread of infection to other parts of India.

ORISSA

H. K. Nandi

Deputy Director of Agriculture, Orissa, Cuttack

THE activities of the Department of Agriculture and Food Production, Orissa, have increased considerably in recent years but the shortage of properly trained personnel is standing in the way of making rapid progress. Orissa, which has recently been made into a separate province, is very short of experts in many important fields. In all plans of future development, it is, therefore, essential that the first step must be the education and training

of the staff for revitalization of agriculture to augment the food resources of the province.

Training of personnel in agriculture

Students from Orissa have been experiencing great difficulty in getting training in agriculture. In order to surmount this difficulty so as to have an assured supply of well-trained officers in the Department of Agriculture, Orissa, as well as in the neighbouring States, this Government, with the help of the Central Government, have initiated a scheme for training annually 50 sub-overseers, and 50 fieldmen at Cuttack Agricultural Farm and 50 fieldmen each at Sambalpur and Khurda Agricultural Farms. The duration of the sub-overseer course is one year and that of fieldmen six months. The initial qualifications of the students for admission are of matric and lower standard not below that of middle vernacular, so as to make them fit for such employment. The object of the scheme is to train the students, who are mostly the sons of agriculturists, in the practice of scientific methods of agriculture. The students are required to do all field operations with their own hands.

To attract suitable youngmen, stipends of Rs. 20 and Rs. 10 per month with free lodging have been awarded to the sub-overseers and fieldmen students respectively. It is expected that this training of the students in modern methods of farming will be of great help in carrying the results of agricultural improvements to the cultivators' fields on a large-scale and consequently in the intensification of agricultural production in the province.

As there is no institution in Orissa for imparting higher agricultural training and the Government of Orissa have provided in their first five years' plan of post-war development and reconstruction for higher studies, the first batch of 25 students have already been selected and sent for training in the graduate course of agriculture in different Agricultural Colleges in India and three students for post-graduate training in different agricultural subjects in the Imperial Agricultural Research Institute, New Delhi. The first batch of seven experienced officers of the Agricultural Department have also been selected and sent for training in general agriculture and research in different institutions in the United States and United Kingdom. An equal number of students will be selected and sent for training in subsequent years.

Prospects of better cotton

The area under cotton in Orissa is about 9,000 acres. The varieties grown are mixtures of different types with short staples, coarse fibre and low ginning percentage. The methods of cultivation in vogue are antiquated and the the yield of *kapas* per acre is very low. Consequently there is a great scope to improve the quality and quantity of this important money crop.

A few years back introduction of long staple cotton was tried in Orissa but without success and the trials were abandoned as it was thought long staple cotton would not thrive here. Similar experiments were, however, undertaken in 1945 with 60 improved types of long and short staple cotton, seeds of which were obtained from different provinces in India. These experiments yielded some valuable results and it is seen that some of the long staple types can be grown quite successfully in Orissa, where the rainfall is low and canal water irrigation is available. A few types of short staple hill cotton of Assam with ginning percentage more than 54, introduced for the first time in Orissa, look very promising. This finding out of the proper types suited to the climate and soil of the province will go a long way to extend cotton growing in the existing cotton areas and to spread it into fresh areas.

The haphazard introduction and trial of cotton in Orissa are being displaced by a systematic trial and selection. Therefore, if the experiments on long staple cotton and better types of short staple cotton are to be made a success, what is most needed at this moment is a definite, active and comprehensive programme involving the full application of our technical knowledge in maintaining the purity of the introduced types as well as the provision of facilities required for the successful cultivation of these cottons under the cultivators' condition. The Department of Agriculture, Orissa, is moving in this line.

Provincial cattle show with agricultural and industrial exhibition

The outstanding event of the months of January and February, 1946, was the opening of the Provincial Cattle Show with Agricultural and Industrial Exhibition held at Cuttack from 28 January to 3 February, 1946, under the auspices of the Utkal Gomangal Samiti. The agricultural section of the show was continued after the combined show was over upto

8 February, 1946, in connection with the visit of Sir William Stampe, C.I.E., Irrigation Adviser to the Government of India, who visited Cuttack on 7 February. The show was held in the spacious grounds of Quilla Maidan and the opening ceremony was performed by Mr. S. L. Marwood, C.I.E., J.P., I.C.S., Revenue Commissioner, Orissa, on 28 January, and it was unique in its character in the annals of Animal Husbandry, Agriculture and Industries of the province. The enclosures for the various classes of animals and the judging rings were neatly arranged. One could hardly believe that Orissa possesses such good breeds and remarkable specimens of cattle, buffaloes, goats, poultry, dogs and horses, such different classes of crops, vegetables and fruits and such a variety of high quality textile products with such artistic designs.

The Civil Veterinary Department demonstrated scientific methods of breeding, feeding, management and control of diseases and pests of livestock in addition to the graded Hariana cattle, Murrah buffalo, Bikaneri sheep, Beetal Black, Bengal and Ganjam type goats. The stalls exhibiting livestock industries, e.g. dairying, poultry, wool, hides and skins, fisheries, etc. were of great educative value to those who had come from various parts of the province to see the show.

The stalls set up by the Agricultural Department with the best qualities of seed, crops, impressive specimens of vegetables and fruits with practical demonstration on the methods of cultivation of fruit and fodder crops, compost-making and other live specimens of different crops were of grand interest to the visitors. In vegetables, the pumpkins, bottle-gourds, tomatoes, cauliflowers, cabbage, knol-khol and potato were surprisingly big. The seedless long brinjals, cauliflowers, Shillong potato and cabbages were equally surprising for their size and quality.

Assam deep water paddy types grown at Cuttack Farm inside a tank with 15 ft. of standing water was actually demonstrated with their stem height of 15 ft. and Assam hill cotton with boll length of 8 in. formed another predominating feature of the agricultural stalls and attracted big crowds. Their introduction in Orissa was very much appreciated.

In the entomology section, collections of samples of insect pests of different crops were demonstrated and these became objects of curiosity. Easy methods of control of insect pests depicted with the help of charts and coloured illustrations were well-grasped and appreciated by the visitors.

In the agricultural engineering section, some of the improved implements and machineries were demonstrated. The practical working of a Persian wheel set up in a well in the Show ground for irrigation attracted the largest number of cultivators and its usefulness was highly appreciated.

The agricultural marketing section had a stall to demonstrate the advantages of grading and marking of agricultural produce. Different classes of weights and measures prevalent in the province were set up and the utility of a standard weight and measure was brought to the notice of the public.

Not the least interesting stalls were those of *gur* and Khandsari sugar-making. A lemon and orange squash bar run by the Agricultural Department was well-patronized.

The stalls with exhibits, charts, posters, etc. set up by the Industries, Cooperative, Public Health and Jail Departments were quite upto the mark and well-spoken of by the people. The Textile Department had put up a demonstration with a dozen handlooms of different patterns on the weaving of clothes. One could hardly believe that Orissa's handloom could produce such a variety of finest quality cotton, silk, *endi* and *munga* textile products with such elaborate and artistic designs.

Another interesting item in the show was magic lantern lectures and exhibition of cinema films, through the courtesy of the Publicity Department, on various interesting subjects concerning agriculture, livestock, public health, and industries.

The various classes of exhibits were judged by a panel of judges. Cash prizes and certificates to the winners of best animals, and agricultural and industrial exhibits were distributed by Mrs. C. S. Jha, Mrs. P.K. Parija and Mrs. S. Das, respectively.

His Excellency, Sir William H. Lewis, Governor of Orissa, who was the Patron-in-chief of the Show Committee and Lady Lewis visited the different stalls and evinced great interest in the various animals, crops, seeds, vegetables, implements and textile products that were exhibited.

An interesting programme of animal sports was arranged on the closing day on 3 February, 1946, inside the show ground. Her Excellency, Lady Lewis, gave away the championship cups

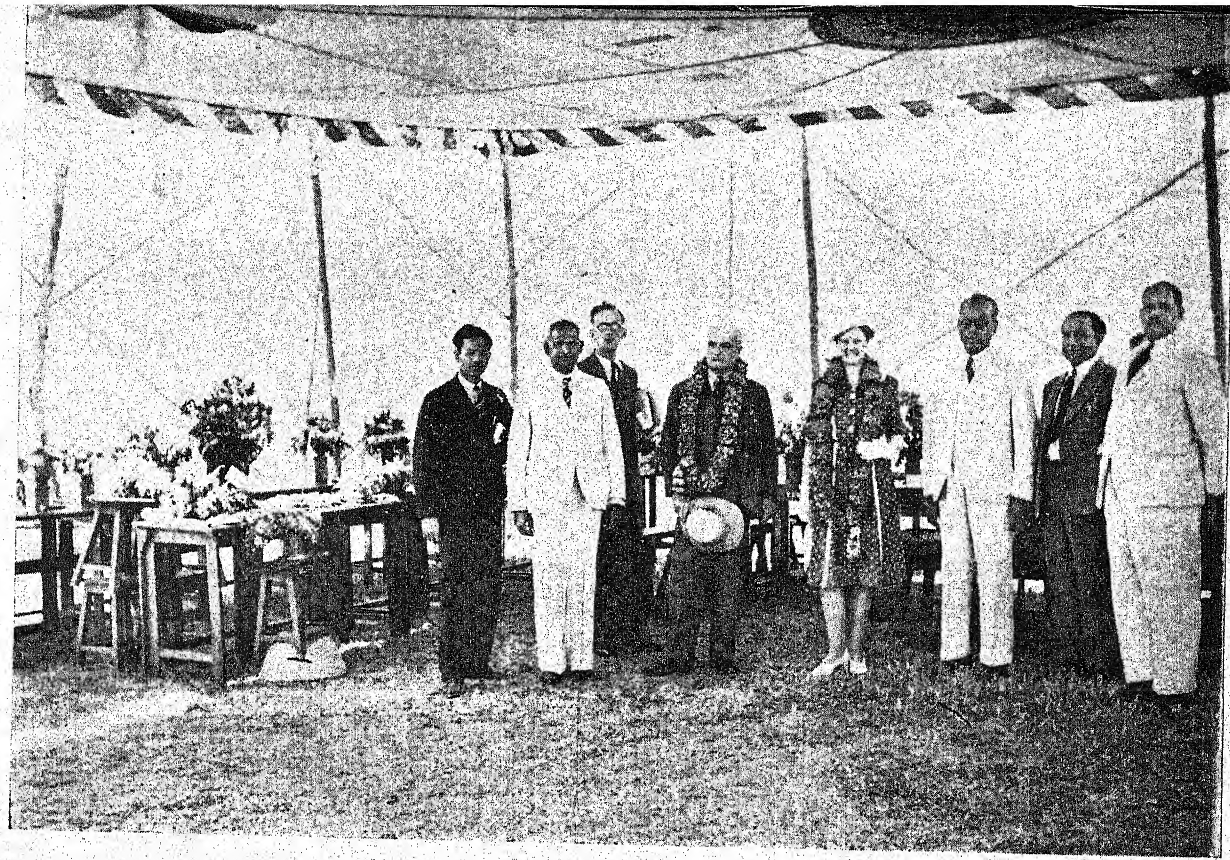

FIG. 1. Their Excellencies visiting the Flower and Vegetable Show

[PLATE 2]

FIG. 2. Vegetables in the exhibition

Fig. 1. Ploughing operations in the garden of the Private Secretary to the Viceroy's residence—a notable lead in the 'grow more food' campaign

Fig. 2. Cattle grazing the once carefully tended lawns on the Viceregal Estate

[PLATE 22

numbering 39 to the winners of the best exhibits.

The show was run by an Executive Committee of 18 members and six Sub-Committees consisting of 36 members, with Mr. B. H. Gokhale, C.S.I., C.I.E., I.C.S., Adviser to His Excellency the Governor of Orissa, as the President. Mr. H. Lal, I.C.S., Director of Development, Orissa, as the Vice-President and Mr. R. L. Kaura, B.V.Sc., M.R.C.V.S., Deputy Director of Veterinary Services, Orissa, as the Honorary Secretary. The show was a great success due to the keen interest taken and ungrudging help rendered by all the members and particularly by Mr. B. H. Gokhale, the President and Mr. H. Lal, the Vice-President. The untiring efforts and hard work of Mr. R. L. Kaura, Honorary Secretary and his staff and the staff of the Agricultural Department also deserve special mention.

The Government of Orissa made substantial contribution towards the expenses of the show and prizes for the exhibits and the All-India Cattle Show Committee, Delhi, paid Rs. 955 towards the cash prizes awarded for the best animal, best Hariana cattle, best Murrah buffalo and the highest milk yielding cows. The Madhabji Lalji's challenge cup for the best departmental stall in the show was won by the Department of Agriculture, Orissa.

Flower and vegetable show

The Cuttack Flower and Vegetable Show which was held on 2 February, 1946, in the premises of Nari Sangha Sadan formed another big feature of activity here. Almost all the classes of winter flowers and vegetables of the best qualities were depicted in the show. Flower pots, vases and cut flowers of roses, dahlias, asters, petunia, sweetpea, antirrhinum, pansies, salvia, larkspur, etc. of different colours and sizes predominated and these were beautifully arranged in between the collections of vegetables such as potato, tomato, turnip, cabbage, cauliflower, knol-khol, beet, French bean, carrot and brinjals of outstanding size and quality.

The show of such a representative collection of beautiful flowers and vegetables and the nice way of their display was the result of strenuous efforts of Dr P. K. Parija and Dr P. Misra, Joint Honorary Secretaries.

His Excellency, the Governor of Orissa and Lady Lewis, visited the show and took utmost delight in going round and examining all classes of flowers and vegetables that were exhibited. Cups and certificates were distributed as prizes by Lady Lewis to the winners of the best exhibits in the afternoon of 2 February, 1946.

THE CUTTING AND TREATMENT OF SEED POTATOES

R. M. Nattrass

Senior Plant Pathologist, Department of Agriculture, Kenya

DURING the present war the need for economy in material and transport has focussed attention on the use of cut sets for potato seed.

The farming and gardening press has given publicity to the practice in Russia and other countries of planting potato peel for seed and at the same time, using the remainder of the tubers as food. The idea is not new. Trials with potato peelings as seed were reported in the Transactions of the Horticultural Society as early as 1834 (Salaman, 1926). The raising of plants from rose ends, sprouts and cuttings has probably been practised by gardeners since the early days of potato cultivation. Evans (1943) has described a method of preparing potato 'chips' for transport by air. The sending of potato eyes by post has long been a favourite method of distributing certified seed in the United States and Canada. In the United States, cutting is a more general practice. Large-size tubers up to $8\frac{1}{4}$ oz. in weight may, in extreme instances, be cut into as many as 10 pieces (Stuart, 1928).

The objections to cutting which have been put forward from time to time are that the yield per acre is less than when whole sets are used and that there are inevitably a number of misses due, in the main, to rotting of some of the pieces and unsatisfactory sprouting of others. The extent to which success is achieved by the use of cut seed pieces is dependent on the healing of the cut surface which is only fully developed under suitable conditions.

The process of the healing of the cut surface of the potato tuber was studied in detail by Priestly and Woffenden (1923). Immediately after cutting, the surface darkens in colour and in dry air forms a hard crust which readily cracks. The surface is usually coated with a white crystalline deposit consisting of salts and starch grains. There is considerable shrinkage and loss of moisture. This is evident when cut tubers are exposed to ordinary drying conditions. If, on the other hand, the cut surface is kept in a moist atmosphere, a different sequence of events occurs. Within 12 to 36 hours, the walls of the cells immediately below the cut surface become covered with a deposit of varnish-like substance (suberin) which forms a continuous layer, blocking the cut surface. This not only prevents loss of moisture but effectively bars the way to rotting organisms such as bacteria and moulds. Within a further period, the duration of which depends on the variety of the potato and the temperature, the cells immediately below the blocked surface divide parallel to it to form a layer of suberized cells which eventually develops into a skin similar in structure and function to the outer skin of the tuber. Potatoes with the surface healed in this way show remarkable resistance to drying and can be treated as whole tubers. The time which elapses before the layer of cork cells is formed and the thickness of the layer varies with different varieties, some having the ability to form the layer more readily than others. The variety *Majestic*, for instance, which is generally supposed to be a bad subject for cutting formed a thinner layer than some other varieties. A Kenya variety showed a deposit on the cell walls 48 hours after cutting, but the commencement of the actual formation of the cork cells did not take place until the fifth day. That almost any part of the potato tuber can react in this way to wounding is shown by the fact that the tunnels made by the tuber-moth larvae are lined with cylinders of cork cells, several cells thick, which effectively cut off and protect from bacteria the living tissue.

The above is the sequence of events which occurs under optimum conditions. It is dependent, in the first place, on the free flow of nutrients to the cells immediately below the cut surface and an atmosphere sufficiently moist to prevent evaporation. If the cut surface is exposed to dry air, a continuous layer of the deposit is prevented from forming. It occurs instead in isolated patches at different levels and is followed by irregular cork cell formation. The result is an inadequate protection against

organisms and drying out of the flesh of the tuber. The drying and shrinking are much accelerated if the cut tubers are exposed to sunlight or drying wind.

The natural healing process can be induced by keeping the cut pieces in a moist atmosphere for three to four days after cutting. This can be done by placing the cut pieces in a shallow layer and keeping them covered with moist sacks or other material. As the healing is dependent on free access to oxygen, care should be taken that the cut surfaces are not actually lying in water.

For many years writers in various countries have recommended drying the cut surface of the tuber by dusting with lime, ashes or some other dry material. Priestly and Woffenden (1923) showed that no advantage followed this procedure. In fact the quick drying of the cut surface interfered with the normal healing process.

Within the last few years (as a result of wartime shortage of seed potatoes in the United Kingdom), the subject has been reviewed. A further series of experiments by Bell, Gilson and Dillon-Weston (1942) confirmed those of the previous writers. They pointed out that the chief objection to using cut sets was the poor establishment following the rotting of the cut pieces, in the ground. This is atrributed largely to the interference with the normal healing process when the surface of the cut tuber is allowed to dry before planting. The treatment of the cut surface with a disinfectant such as copper sulphate, or by dusting with lime, did not help the healing process. These writers emphasized, however, that the freshly-cut seed piece planted at once in moist soil heals rapidly enough to prevent the ingress of rotting organisms. Dillon-Weston and Taylor (1944), later reaffirmed previous findings on the strong healing-powers of the potato tissue and showed that treatment by disinfectants may actually impair the process. Marritt (1944), however, found that potato eyes cut from tubers previously treated with an organic mercury dip gave a better stand than those from undipped tubers and that washing the cut sets with water was more reliable than dusting the cut surface. The most suitable packing was found to be moisture-tight packages in which sufficient moisture would be maintained to continue the healing process.

The practical implications of the above facts are clear. Cut tubers, if not to be planted immediately in moist soil, should be kept in a moist atmosphere for three or four days. Thus, in Cyprus, where the cut pieces are planted either in spring when the soil is naturally moist, or in summer when the land is irrigated, there is little loss from rotting of the seed pieces. On the other hand, as has been pointed out by Arnold (1941), in Rhodesia, where potatoes may be planted in dry soil some weeks before the rains, it is necessary to induce healing by the above method before planting.

Reference may here be made to the preparation of potato eyes as ' chips '. In experiments carried out at Kew (Evans, 1943), the cut pieces were kept in a storeroom at room temperature and showed a loss of weight of about 12 per cent after 24 hours and about 65 per cent after one week. It is stated that ten days after cutting, the pieces had shrivelled to about half the original size and looked like ' slips of cardboard '.

Applying the principles of healing described above, ten rose ends weighing about four grams each were placed on damp sand and kept in a moist atmosphere in a Rodewald germinator at room temperature (Nairobi). After four days the pieces were removed and weighed 40·2 grams. They were then left exposed for two months in the laboratory during the dry season. At the end of this period, the ten pieces weighed 30·9 grams, the loss of weight being rather less than 23 per cent.

By this method there is not the saving of weight for air transport which is achieved when the pieces are prepared as ' chips ' by the Kew method, but it is suggested that this may, on occasion, be more than compensated for by the length of time they can be kept before planting and their resistance to invasion by soil organisms.

It is generally agreed that the rose ends of halved tubers give better yields than do the heel ends. Experiments at Salisbury, Rhodesia (Arnold, 1941), showed a 50 per cent increase in yield from rose ends over heel ends. It is known that the developing sprouts which are first produced at the rose end inhibit the development of sprouts situated elsewhere. It is on this account that the usual practice is to cut the tubers longitudinally so that each half has a share of the apical eyes. This does not seem to be necessary if the tubers are cut when fully dormant. Large tubers can be cut transversely and longitudinally and will then produce good plants from each portion. If, however, sprouting has already begun the established practice of cutting longitudinally is to be preferred.

In Kenya, difficulty is frequently experienced in keeping seed potatoes from one crop until the next planting time. To prolong the keeping time as long as possible it is important that the tubers are mature with the skin set. In production of potatoes, especially for seed, cutting the haulm when the majority of the tubers has reached seed size and leaving them in the ground for two or three weeks will generally ensure a well-set skin. If these are then 'greened' by exposure to diffuse light, the keeping quality will be improved. The period of dormancy is about three months, after which sprouting will begin. If the tubers are stored so that each is exposed to the light, short, sturdy sprouts will develop which will increase in length very slowly.

Of particular importance to producers of both seed and ware potatoes in Kenya is the effect of exposure of the tubers to the direct rays of the sun. This, combined with the lifting of immature tubers, is responsible for considerable loss in the Kenya markets. It has been pointed out (Rose and Schomer, 1944) that in the U.S.A. much of the bacterial rot which occurs in transit and storage can be attributed to the effect of exposure to the direct rays of the sun. That this is generally realized in the States is the term 'sunscald' applied to storage rots and blemishes in general.

Even when tubers are fully mature and the skins set, exposure to the sun for a short time will cause damage, the effects of which may not develop until some hours later. Tubers of the *Kinongo* variety kept at 40° C. for four days shrunk considerably and the flesh darkened and had a rubber-like consistency, while liquid oozed from the eyes. This temperature may well be exceeded in the field. Rose and Schomer (1944) also demonstrated, by means of infra red lamps, that tubers can absorb heat from such a source and develop a temperature several degrees higher than that of the surrounding air. At Nairobi in January, a thermometer inserted to the centre of a large tuber exposed to the sun registered, after three hours, a temperature of 50° C., while the air temperature over the tubers was only 32° C. Moreover the temperature of the soil on which the tubers may be in contact at times reaches a temperature of 60° C., sufficient to subject them to mild cooking.

The damage caused by such exposure is more noticeable when the tubers are lifted before the skin has set and have suffered some skinning and bruising during handling. The unsightly dark brown skinned areas of potatoes seen in the Nairobi markets show that such maltreatment is by no means uncommon. The potatoes do not keep well; in bulk they tend to heat up and much loss is caused by bacterial rot, which first affects the tubers which have had their natural resistance broken down by heat.

Suberization or healing takes place on the skinned areas in much the same way as on cut surfaces. In the shade and shielded from drying wind suberization will occur in the outer cells and much shrinkage and loss of moisture may be prevented. Exposed to the sun or to a drying wind suberization occurs only at some depth below the surface.

Care is needed at lifting time and in dry weather potatoes should be bagged or suitably protected as soon as possible after lifting. If wet, they should be dried in the shade. Neglect of these precautions is one of the causes of the difficulty experienced in Kenya in storing potatoes for any length of time.—Adapted from *The East African Agricultural Journal*, Vol. XI, No. 2, October, 1945.

The Month's Clip

AGRICULTURAL INSECURITY IN RAJPUTANA

THE most stupendous problem in Rajputana is that of agricultural water supply. Rainfall in Rajputana is very unequally distributed—the annual average rainfall being 10·2 in. in Bikaner in the west, 24·9 in. in Jaipur in the east, and 31·8 in. in Sirohi in the south, and is highly precarious. The uncertain character of rainfall coupled with the comparative infertility of soil is responsible for the low and insecure agricultural productivity of the region which is liable to frequent famines or years of scarcity. During the last hundred years there have been many cases both of extreme and general scarcity of food-stuffs causing wide-spread suffering and distress. In the current year as well there is an acute shortage of food-grains in Udaipur and other States and also in the British territory of Ajmer-Merwara on account of the partial failure of the *kharif* crop ; and the failure of the winter rains in many places is bound to aggravate the trouble by impoverishing the standing *rabi* crop.

Western Rajputana

Rainfall is a factor of prime importance in the agricultural economy of the region. Though primarily intended for the grain crops, it is scarcely less necessary for the growth of grass on which cattle, forming one of the principal parts of the wealth of the rural population, are almost exclusively dependent. In western Rajputana it is totally insufficient, and, therefore, the cultivators find it very difficult to raise crops even though they try their utmost to conserve moisture and minimize its waste. The surface of the country is for the most part covered with undulating sand-hills, and between the ridges of sand, there are, at some places, firmer and loamy soils which can produce fairly good crops of wheat, barley and gram if the water supply is adequate. Generally, however, it is precarious, and the supply of sub-soil water also is very limited. Moreover, the salinity of well-water renders it less useful to the plants. Thus agriculture often suffers from an early cessation of the monsoon or an unseasonable distribution of rainfall or failure of winter rains.

Light and sandy soils are very poor from point of view of agricultural productivity. They are, of course, well adapted to the scantiness of local rainfall, and produce *bajra*, *moth* and *guwar*, etc., in small quantities for the struggling agricultural community. By far the largest area is occupied by *bajra* and *moth* which are the staple food-stuffs of the villagers. The predominance of *bajra*, in itself, is an indication of the comparatively large extent of inferior soil, and a 'sign of agricultural distress'. In normal years the hardy desert grasses and shrubs thriving on a minimum of moisture cover much of the area, and afford plentiful pasturage for large herds of cattle. In years of drought, however, they become parched up and the crops also wither away resulting in fodder scarcity which is generally the first symptom of famine. The consequent death of thousands of cattle lands the agriculturists in great difficulties inasmuch as plough animals fall short of demand, and this leads to inefficient tillage and augmentation of rural indebtedness.

Eastern and southern Rajputana

In eastern and southern Rajputana rainfall is more, and the problem of agricultural water supply not so acute. Here agriculture is more important than it is in western Rajputana, and gives employment to a much larger number of people. The mean density of population per square mile is as high as 247 in Bharatpur in the east, 124 in Mewar in the south, whereas it is only 5 and 41 in Jisalmer and Bikaner respectively in the west. However, agricultural prosperity here as elsewhere depends, as a rule, not only upon the amount of rainfall, but also on its proper distribution over the different months of the year. Agricultural operations of the year get very much upset when, during the *kharif* season, insufficient amount of rain occurs or it ceases prematurely. Under such circumstances the bulk of the *kharif* crop is either not sown at all, or if the showers at the beginning of the season have led the cultivators to put the seed in the soil, the young plants are dried up and withered for want of adequate moisture. Consequently a

period of general scarcity prevails all over the land, specially in those places where large areas are devoted to the cultivation of *kharif* crops. The *rabi* crop is also equally susceptible to an inopportune and deficient rainfall. The cultivators in such tracts have, therefore, to adapt their systems of tillage to the exigencies of the season which create abnormal conditions in agricultural operations.

Many a time incalculable damage to standing crops has been done by flying locusts and young hoppers. In July, 1945, for example, heavy locust invasion started in Jaipur State, and anti-locust measures had to be taken at once in order to combat the menace which is rightly regarded as a fore-runner of famine. In Jaipur and many other States special organizations have now been set up to fight this menace.

Inefficient agriculture

In this region the rulers have, in many cases, provided irrigation facilities which help the cultivators to make the best use of land and to tide over periods of drought, e.g. Jaipur State alone has got about 350 irrigation tanks and reservoirs and about 25,000 wells. Here the soil is generally more fertile and yields fairly good crops of wheat, barley, gram, cotton, etc. Double-cropping is also practised on a larger scale, but is confined to those areas where facilities for irrigation or a natural supply of water are available throughout the year. The vagaries of rainfall, however, have to be met with here as well, and its failure makes all the difference between a sixteen and an eight anna crop.

Due to unfavourable geographical factors, agriculture in Rajputana except in some places, is very inefficient and backward. Insecurity of harvests is its dominant cause. The outturn from land is extremely poor, and is not at all comparable with the neighbouring British Indian provinces. As mentioned above, droughts are common in Rajputana and in such cases the cultivators are confronted with two alternatives of either abandoning the cultivation or risking it in the hope of getting rains in future. The abject destitution of the cultivators, however, compels them to risk the cultivation rather than to go without it totally. The inevitable consequence is that the crops which are thus spread over the whole area suffer as a whole on account of the deficiency of moisture and the average yields become very poor. The absence of a business view towards agriculture, however, enables them to carry on, season after season, with the cultivation of lands which are not worth cultivating unless they are richly manured and watered.

Defective land tenure

The existing system of land tenure is another cause of agricultural poverty. In the majority of the Rajputana States *Jagirdars* have got control over about two-thirds of the land where conditions, generally speaking, are still nearer the feudal economy and where productive impulse is lacking on account of frequent harassments of the peasantry. In *Khalsa* areas, however, conditions are better, and there is greater incentive to produce more.

A vicious circle

It is thus clear that agriculture in a major portion of Rajputana is almost entirely dependent upon a single phenomenon of nature and that it is characterized by great insecurity. There is a kind of vicious circle inasmuch as agricultural insecurity leads to poverty, and poverty makes the agriculturists totally unable to overcome the natural obstacles. The people are not bad cultivators, but unfortunately, they are hopelessly handicapped by uncertainty of water and the resultant insecurity of harvests. They have to take risk almost every time they begin their sowing operations.

Suggestions for improvement

What is needed, therefore, is to bring within the reach of the agriculturists greater knowledge and skill, improved equipment and all the rich resources of science. The task is, no doubt, formidable, but it will have to be performed if agriculture in Rajputana is to be saved from a state of perpetual insecurity. All the States should, therefore, cooperate in increasing water supply by means of afforestation and the extension of irrigation facilities, and in controlling the sand-dunes. Only in this way can agricultural insecurity be checked and the economic condition of agriculturists considerably improved.—Reproduced from *The Eastern Economist*, February, 15, 1946.

ERADICATION OF PRICKLY-PEAR

George Mulgrue

NO one really knows who first brought the prickly-pear to Australia. There is a story that Governor Arthur Phillip did it to provide food for the cochineal insect, so that he could have dye for his soldiers' coats. But that probably is not true. What is much more likely is that some one thought that cactus plants would be nice as ornaments in the garden.

The menace

There came a time when it seemed that the plant would take over the whole country. It was not the originally imported plants that did the damage. No one heard much of the prickly-pear till farmers began about 1860 to to use it for hedges and as cattle food. By 1900 it was becoming a real menace. People began to realize that something must be done. The only trouble was that no one knew what. To attack the pest with mechanical and chemical methods would cost about Rs. 85 an acre, and as the land was only valued at between Rs. 2-12 and Rs. 16 an acre, this was obviously uneconomic. A search began for some other way to fight the pest.

In the meantime, the prickly-pear was really getting under way, and by 1925 had taken over an area of 1,000 miles long in Queensland and New South Wales, almost as far south as Sydney. The pear occupied an area of more than 60,000,000 acres, which included some of the best country—a belt that began about 50 miles from the coast and extended up to 300 miles inland. The rainfall of these parts was from 20 to 30 in. and it contained land suitable for sheep and cattle grazing, dairying, and the growing of maize, wheat and cotton. Some of this country was as yet unoccupied, but much of it had already been settled and the settlers were fighting a losing battle against the invasion. They tried ploughing the pest, crushing it and a hundred other things, but they were mostly hampered in these mechanical methods by the heavily timbered nature of a great deal of the country. In the end, poisoning, usually with arsenic in some form was found to be the only method possible, but this too was far too expensive, and gradually more and more of them gave up the struggle and abandoned their farms.

There seemed to be no remedy, and in 1924 the Queensland Prickly-Pear Commission announced that the task of clearing was impossible and that even if it were not, the cost for the first clearing alone would be in the neighbourhood of Rs. 85,60,00,000.

Possibilities for biological control

But the scientists were not satisfied. Back in 1912, an almost forgotton Commission had reported that there was a future for biological control of the pest; that there were insects that could hold down cactus growth. In 1920 scientists had persuaded the Governments of the two prickly-pear infested States, Queensland and New South Wales, and the Commonwealth Government, to cooperate and form a Prickly-Pear Board, which was to work on the findings of the earlier Commission.

Entomologists were sent to America early in 1920, and while the Queensland Prickly-Pear Board was making its gloomy announcements, they were working quietly at a field station they had set up in the United States. There were several little insects that were known to be enemies of the pear, but the scientists' problem was bigger than that. Before they could import any of them into the country, they must be sure of several things. The chief of these was, would the insects when imported into Australia, turn on other forms of vegetation? Would they destroy the prickly-pear, only as a prelude to destroying valuable food crops? The scientists had to be sure of these answers, because so much of Australia's production comes from the land.

Cactus-killing parasite

The patient work went on and before long the scientists found that while there were several parasites that tended to destroy the prickly-pear, one of them was sudden death to it. This was the Moth Borer known as *Cactoblastis cactorum*, and it came from Argentina. They began to concentrate upon it. They studied its life history and its effect on various hosts. It was found that it could live on the cactus plant and on the cactus plant alone. They found, in fact, that this was the result with almost all of the cactus-attacking parasites. It seems that the cactus family has its own definite insect fauna. Very few of these will

live on any other form of foliage, just as very few insects that live on other plant can survive on the cactus.

Import of Moth Borer

Having established the fact that the *Cactoblastis* would not be a danger to any other plants in the country, scientists felt it would be safe to introduce it into Australia. The field stations in America and the Argentina collected selected insects and their eggs and brought them to Australia. The first batch of eggs arrived in Australia in the larval stage in 1925. During the next spring, the larvae turned to moths, which laid 100,650 eggs. They were kept in rearing cages, and the next generation numbered 2,540,000 eggs. There was a 900-fold increase in 12 months, for two generations of *Cactoblastis* are born every year.

Mass distribution of eggs

The first experimental liberation went on until the end of 1927. By then 9,000,000 eggs had been distributed in lots of from 100,000 to 250,000 all over the affected country. It was not long before it became obvious that rearing in cages was unnecessary. The insects increased so much in places where they had been liberated, that it was only necessary to collect the eggs from nearby plants and spread them in other places. Mass distribution began in 1928, and went on until 1930, by which time roughly 3,000 million eggs had been distributed.

The method was simple. The little sticks of eggs were lightly glued to squares of paper or placed in waxed paper quills, and the squares or quills were pinned to the cactus plants. The insects multiplied so rapidly that big gangs of men equipped with trucks had to be employed to spread the eggs far and wide. Within six years of its importation, *Cactoblastis* was firmly established from one end of the pear belt to the other.

Amazing results

The result was successful beyond all expectation. By the end of 1928, each liberation area showed about 1,500 acres of ground cleared of cactus, and by 1932, vast tracks of pricly-pears had been reduced to pulp, in a most spectacular manner. In fact in August of that year, 90 per cent of the pear had disappeared.

Battle not over

But even then the battle was not over. For by killing off the cactus, the little *Cactoblastis* was virtually committing 'suicide'. It could live only on cactus, and that was nearly all gone. The *Cactoblastis* began to die off in a most alarming way, and in the meantime the cactus was growing again. The seeds from the rotted plants had fallen to the ground, and because there was no *Cactoblastis* to control them, they began to expand just as they had done in the years gone by.

However, the *Cactoblastis* had not died out completely, and very soon it was flourishing again. By the end of 1934, all the area of regrowth was under control again, and now although there are times when the cactus seems to be getting under way once more, there is no cause for alarm. For whenever the cactus starts growing the *Cactoblastis* starts too.—Reproduced from *The Journal of Scientific and Industrial Research*, Australia, January, 1946.

New Books and Reviews

FOOD FAMINE AND NUTRITIONAL DISEASES IN TRAVANCORE

By K. G. Sivaswamy, K. K. Chandy, T. S. Shastry and Nine Other Medical Men (Published by Servindia Kerala Relief Centre, R. S. Puram Post, Coimbatore, July 1945, pp. 290, Rs. 5).

THE EXODUS FROM TRAVANCORE TO MALABAR JUNGLES

By Shri Sivaswamy, T. S. Shastry and Five Other Medical Practitioners (Published by Servindia Kerala Relief Centre, R. S. Puram, Coimbatore, August 1945, pp. 43, Re. 1).

TRAVANCORE passed through a food famine during 1941 to 1944. The workers of the Servants of India Society, and their helpers carried out relief operations, gave medical help and also collected data of the economic and wealth conditions in the villages. A detailed survey was carried out in December, 1941, of the conditions of 500 families in Shertellai taluk by a team of teachers, students and social welfare workers under Mr. K. K. Chandy. A second survey was carried out in September, 1944. The technique of random sampling was not however adopted. The method followed was of selection of villages considered to be typical. In a similar survey of a small number of villages by the Department of Anthropology, Calcutta University, the generalized estimates were found to be higher than those obtained by a latter and more accurate sample survey by Prof. K. P. Chattopadhyay in collaboration with the Indian Statistical Institute. The lower limit of the estimates of the earlier survey however turned out to be just within the range of the final, accurate estimates.

It is probable that the conditions observed are representative of the particular sector in which the surveys were carried out by Mr Chandy, Dr Miss Philip and others. The writers of the report have sought to correct this limitation by a careful comparison of parish records of deaths in a much larger area with that noted in official records. The medical workers have also carried out nutritional diet surveys in several other villages, in 1945. Hospital statistics regarding nutritional diseases have also been analyzed. The picture that has emerged from these combined labours is extremely bleak. In normal times the people seem to have been undernourished and living from hand to mouth. When unemployment came and prices rose, the people died in large numbers, and those who survived are diseased and often too weak to work. Migration occurred on a mass scale to Malabar in the hope of better living conditions. But the survey of colonies formed by these emigrants (*The Exodus from Travancore to Malabar Jungles*) shows a high death rate due to malaria and other diseases of malnutrition. Many of these persons had sold everything to build a new home in Malabar, but lost their little capital owing to high prices of food. Older settlers also seem to have had no hesitation in cheating these men, while the ban on export of tapioca by the Madras Government led to a local surfeit of this crop in the area of the settlers. In consequence, the merchants made big profits at the expense of the cultivators.

The villagers of the affected areas who remained behind, did not also fare much better as noted. Apart from a high death rate, loss of earners through mortality, as well as migration, left a large number of women and children helpless and destitute. Schools also broke up and attendance fell sharply due to lack of food and clothing. The picture in fact is very much like that of rural Bengal during 1943 and 1944.

The same kind of maladministration of relief, inadequate planning of supplies, refusal to enlist cooperation of honest welfare workers and representatives of the people, appear to have occurred in Travancore as in Bengal. From an elaborate and careful analysis of facts in a chapter entitled 'Food Shortage and Controls', Mr Sivaswamy shows how badly the State authorities and the Government of India handled the situation. We read also that while people were starving, the State sold grain at a price much above that paid for it. In consequence, poor people could not purchase grain, and large stocks remained unsold. Bad storage spoilt lentils and pulses and consumers were forced to purchase these. While the poor people who depended on basic rations got an inadequate quota of the same, the Government

servants were allotted double rations. A fund which was collected for feeding school children, was not spent for this purpose. The money was funded and only the interest allotted for school children while thousands were starving. Comment on these facts is superfluous. This particular chapter ends with a useful note on future measures recommended by the writers to be adopted to improve the existing conditions.

The reports are extremely valuable as indicating how bad the economic and health condition of the common people of Travancore are and to what extent the mechanical official administration without the check of popular cooperation fails to serve the needs of the people in emergencies.—K.P.C.

INDUSTRIAL LOCATION

By Bimal Chandra Ghose (Oxford Pamphlet on Indian Affairs No. 32, 1945, pp. 32, 6 as.).

THE traditional approach to the problem of industrial location has so far been generally in the context of a static phenomenon far removed from the grim realities of a dynamic society. What the pamphlet under review stresses is that apart from the usual economic factors affecting costs, social or State policy in many matters can be made to exercise a vital influence on the locational distribution of industries in a country.

Like all other industrial countries of the world, India also suffers from the vast disparities between regions in respect of industrial development. Urbanization and intensive concentration of industries in a small locality—the two characteristic features of modern industrialism— bring in their train a variety of social and economic evils and are to be deplored from the strategic point of view. It is, therefore, the firm opinion of the author that there should be a proper planning of our resources on a regional basis in the post-war period. For this he suggests the establishment of a central authority capable of coordinating the activities of different regions in the interest of the country as a whole, primarily by a system of licensing of factories. This, the author emphasizes, is not possible without the formation of a National Government. At a time when the word 'planning' is on every lip, such studies are really welcome. For a general reader, it would serve as an excellent exposition of one of the most important problems of industrial economics and can be safely recommended for all those interested in the industrial planning of our resources.—M.K.G.

NEW BOOKS RECEIVED

English :

Architecture, Edited by Claude Batley (Oxford Pamphlets on Indian Affairs, Published by the Oxford University Press, Nicol Road, Bombay, pp. 32, As. 6).

Tibet, Edited by David Macdonald (Oxford Pamphlets on Indian Affairs, Published by the Oxford University Press, Nicol Road, Bombay, pp. 31, As. 6).

Hindi :

Kalyan, Vol. XX, Nos. 1 (Cow Number) to 5, Edited by Hanuman Prasad Poddar and C. L. Goswami, M.A. (Printed and published by Ghanshyamdas Jalan at the Gita Press, Gorakhpur, U.P.).

From All Quarters

DEVELOPMENT OF TOBACCO CULTIVATION

THE inaugural meeting of the Indian Central Tobacco Committee held in New Delhi has decided that the headquarters of the Committee will in future be at Bombay. The Committee also approved proposals to increase the inspectorate staff under the Agricultural Marketing Adviser, in connection with the Central Government's scheme for the compulsory grading of tobacco for export from India.

Sir Herbert Ray Stewart, Vice-Chairman of the Imperial Council of Agricultural Research, who presided at the inaugural meeting, reviewed the work of the previous tobacco committees. He pointed out that tobacco had not received much attention in the past for various reasons. Nevertheless, it was important to trade and industry. During the war, a new type of Virginia tobacco, called *Amarelo* 5, had been evolved at Guntur, and is claimed to be superior to *Harrison Special* in certain qualities, such as earliness, shorter curing time and larger percentage of high-grade leaf. He also mentioned the valuable contribution which had been made mainly by trade interests by the introduction of Virginia cigarette tobacco in limited areas in the country.

Sir Herbert claimed that the establishment of the Indian Central Tobacco Committee marked the beginning of practical and concerted action to improve and develop all types of tobacco. The tobacco crop occupies less than one-half of one per cent of the total cropped area in the country. Discussing the work of the Indian Central Tobacco Committee, Sir Herbert said there had been some delay in setting up the Committee. Though this was to be regretted, it had its advantages, for, in the meantime, funds had accumulated from the annual grant of Rs. 10 lakhs which first became available in 1943, and the Committee could now proceed with its plans in the security of these reserves. A considerable sum of money would be needed for such activities as the establishment of experimental farms, research stations and a technological institute, all of which required not only staff but lands, building and equipment.

He referred to the assistance received from various sources in the setting up of the Committee, particularly from the Indian Leaf Tobacco Development Company who placed at the disposal of the Imperial Council of Agricultural Research, since November, 1943, the services of one of its senior officers for appointment as Tobacco Adviser at a purely nominal salary and for agreeing to continue that assistance till March, 1947, when the Committee expected to be in a position to provide its own Adviser.

The Committee elected Mr. Mohanlal Ambalal Parikh, representative of the Federation of Indian Chamber of Commerce and Industry, as its first Vice-President. A number of sub-committees were also appointed to deal with finance, agricultural research and development, marketing, technology, etc. It was announced that the Imperial Tobacco Company of India had awarded two annual studentships of the value of £500 per annum for training abroad in agriculture with special reference to tobacco cultivation.—*Indian Information*, January 1, 1946.

TAPIOCA AS A POISONOUS PLANT

IN the year 1942-43, an investigation into the toxic properties of the leaves of tapioca was done in the laboratory of the Medical College, Madras at the request of the Director of Agriculture, Cochin State (Trichur). The samples obtained from Cochin State were found to contain hydrocyanic acid in the following proportions:

(i) Fully matured green leaves (without stem) ...1·5 mg. in 100 gm. of the leaves or 0·0015 per cent

(ii) Tender leaves (without stem)...2·6 mg. in 100 gm. of the leaves or 0·0026 per cent

From literature on the subject it can be seen that there are two varieties of tapioca and that they are popularly known as (i) sweet cassava and (ii) bitter cassava. The sweet cassava is not acrid to the taste and is devoid of the poisonous principle and is eaten fresh. The bitter cassava is harder than the sweet one and

contains hydrocyanic acid in all its parts. The plant contains a cyanogenetic glucoside and an associated enzyme which liberates hydrocyanic acid. The hydrocyanic acid content of the plant will vary according to the climatic conditions, the nature of the soil, the method of cultivation, etc. of a particular locality. The highest proportion of the toxic principle occurring in the stem and the young leaves is known to be as much as 0·1 per cent. According to certain authors 5 lb. of the plant containing 0·02 per cent prussic acid is fatal to a cow. In certain parts, freshly harvested and chopped leaves of this plant are consumed by cattle with impunity whereas the roots, if stale and not freshly chopped, cause poisoning. This is attributed to the possible destruction of the enzyme or to the inhibition of its activity by the gastric juice. Tapioca leaves, in spite of their varying hydrocyanic acid contents, are used as fodder to cattle but they are invariably chopped, boiled and washed before feeding, thus eliminating the bulk of the hydrocyanic acid. The prussic acid contained in the root is known to be got rid of by suitable methods before the root is used as an article of food. One of the methods is pressing it and exposing it to fire on an iron plate.—Capt. K. Venkatachalam, Research Officer, Medical College, Madras.

VEGETABLE OIL PRODUCTS CONTROL ORDER

By a Notification published in the Gazette of India to-day the Vegetable Oil Products Control Order 1946 comes into force immediately throughout British India in supersession of the Vegetable Oil Products Control Order 1945. It provides for the appointment of a Vegetable Oil Products Controller for India empowered to control production, distribution and movement of hydrogenated oil or any oil containing more than 50 per cent of hydrogenated oil. No producer shall after such date as the Controller may notify, dispose of any vegetable oil product except to a recognized dealer or to a person specially authorized to acquire vegetable oil products on behalf of the Central or a Provincial Government or an Indian State. Every producer and recognized dealer shall comply with the Controller's directions regarding the quality, sales, stocks and distribution as may be laid down from time to time.

The Order authorizes the Controller to prohibit or restrict the manufacture, stock or sale of any variety or quality of vegetable oil products and also fix maximum prices of vegetable oil products after due notification in the official Gazette.

All notifications, etc. issued under the Vegetable Oil Products Control Order 1945 in so far as they are not inconsistent with this Order shall remain in force as having been issued under the present Order.—*Press Note, Food Department*, March 17, 1946.

Board of Agriculture and Animal Husbandry in India, Crops and Soils Wing Meeting, New Delhi, December 1945

PLATE 23

INDIAN FARMING

ISSUED BY

THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH

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SOYA BEAN

WITHIN recent months much has been said and written, some of it in this journal, of the merits of soya bean as an article of food. We have now before us the *Report on Soya Bean* submitted by the special sub-committee of the Indian Research Fund Association's Nutrition Advisory Committee. It is an authoritative statement which does nothing to strengthen the opinion that in the soya bean lies the solution of many of India's dietetic problems. The Woodhead Famine Inquiry Commission agreed with the finding of the Nutrition Advisory Committee. We learn from the Committee's report that the bean was introduced into America as long ago as 1829 and to Europe in 1873 where it has been grown extensively in the eastern countries. In the United States it is now a crop of importance, no less than 2·625 million tons being produced in 1941. It has not been cultivated to any great extent in India although 30 years ago some 20,000 acres were being grown in north Bengal, Nepal, Bhutan and Sikkim.

The Nutrition Advisory Committee in 1937 stated that 'The nutritive value of soya bean has been studied by experiments on animals and also by controlled experiments on school children. The general conclusion is that soya bean, considered as a supplement to typical Indian diets, is not of outstanding value; it does not appear to have any advantage over various common pulses which have long formed part of the diet of the Indian people. While it would be advisable that the results obtained in the Coonoor Laboratories should be confirmed elsewhere, existing data suggest that at present the encouragement of the production and consumption of soya bean need not be made a prominent part of nutritional and agricultural policy in India'.

The soundness of that opinion was questioned both within and without the Committee, so that at the seventh meeting of the Committee in 1941, it was decided that 'further work was necessary to elucidate the problem'. Accordingly a sub-committee was appointed to suggest lines on which further experiments on soya bean might be carried out by different laboratories, and it is the record of the work done by experts in the laboratories in Dacca, Bombay, Lahore and Coonoor that is to be found in the present report. Be it understood that it is the nutritive value of the bean that is under examination and that an examination of its many other attributes did not form a part of the Committee's duty. The industrial value of the bean is beyond question; the residue of oil extraction is a valuable cattle food, the yield per acre is high. The work with which the sub-committee was confronted was an examination of the growth-promoting value of the bean and of its relative ability to adequately supplement poor rice or other cereal diet.

As regards the value of the bean as a milk substitute for infants, Mackay assesses the value of the work published up to 1940 in the following words: 'No authors have published any detailed statistical results whereby the progress of babies given soya preparations can be compared with that of similar babies living under similar conditions but given preparations of cow's milk. Judging by the statements and conclusions of the authors, it seems, as might be expected, that babies fed on soya flours without any admixture of cow's milk do not, on the whole, make as good progress as babies having milk as the basis of their diet'. The Committee's opinion on the subject is that 'It is clear the question of using soya bean in the feeding of infants and children in India needs to be approached on an experimental basis, and with caution. A necessary

preliminary step would be careful trial in infant welfare centres of suitably supplemented preparations of soya bean. A mixture such as that successfully used by Mackay might be given a trial. Until investigations along these lines have been carried out, there are insufficient grounds for advocating the general use of soya bean 'milk' in infant feeding in this country'.

The growth-promoting property of soya bean milk was tested at Dacca on rats against that of cow's milk using a poor rice diet as a basis. In eight months the rice diet alone produced an increase in weight of 3·44 grams; that diet supplemented with cow milk produced 8·65 grams, and with soya bean milk 7·25 grams. At Coonoor when the bean was given as a supplement to a children's poor rice diet, not only did the children in the basal diet group lose weight but those in the supplementary diet group lost even more. The result of a similar experiment at Lahore was that 'statistical analysis showed that the group receiving soya bean showed no significant advantage, as regards increase in weight, over the group receiving '*dal mash*'. In a series of other experiments the following results were obtained:

1. The average weekly increase in body weight of the rats receiving a supplement of soya bean milk was slightly lower than that on cow's milk, but more than double that on the rice diet alone with no supplement.

2. The group receiving soya bean showed no advantage, in respect of increase in weight, over that receiving black gram.

3. The crude protein content of soya bean is nearly twice that of the other pulses, the 'available' or 'net' protein content of the former was found to be one and a half times to twice that of the latter.

4. Similar results as regards relative biological values were obtained by the growth method, in which young rats were used and protein was supplied at a 10 per cent level of intake.

5. The biological value of soya bean proteins was found to be of the same order as that of the proteins of the other pulses.

6. The addition of soya bean and the other pulses enhanced the growth-promoting effects of the basal rice diet, but the supplementary effect of soya bean was not found to be superior to that of the other pulses. Growth per unit weight of the test diets consumed was also investigated. The basal rice diet gave the poorest results. The diets containing soya bean were not superior to the other test diets in this respect; there was some indication that the diet including Bengal gram was more efficiently converted into tissue than the other diets.

7. Although soya bean contains more of fat, minerals, vitamins and available proteins than other pulses, it has, for some unknown reason, not proved itself superior to other pulses within the range of experiments reported here. It is, however, possible that soya bean may, as has been pointed out elsewhere, prove a better supplement than other pulses to typical Indian diets which are quantitatively inadequate and based on cereals. Further work on this aspect is desirable.

The final opinion of the sub-committee is that 'Taking the results obtained so far into consideration, the sub-committee is of the opinion that as a supplement to typical Indian diets based on cereals, but supplied adequate in quantity, soya bean has no special advantage over common Indian pulses.' And 'The sub-committee is not in a position therefore to advocate immediately the encouragement of the production of soya bean on a wide scale in India for use as a substitute for Indian pulses. The question should, however, be reconsidered if and when further evidence on the nutritive value of soya bean becomes available.'

The position for the time being appears to be fairly clear as far as India is concerned where the use of food for industrial purposes cannot be contemplated. It is that the value of soya bean can be measured by its yield per acre against that of other pulses and that it is a poor milk substitute but a valuable addition to a deficient milk supply. In the latter respect it somewhat resembles the position of *vanaspati* with regard to *ghee*—both soya bean and *vanaspati* must be used to augment a deficient supply of a superior article while neither can be a substitute for it.

Original Articles

IMPROVEMENT OF QUALITY IN MARKET EGGS

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THE average Indian diet is seriously deficient in quantity as well as quality, particularly in regard to essential nutritive and protective constituents like proteins, vitamins and minerals. The egg, which is one of the choicest of human foods, is specially suited to rectify these deficiencies. The average *per capita* consumption of eggs in this country has been estimated to be only about eight a year, which is very low. Though economic factors, dietetic habits, religious prejudices and other similar reasons tend to keep egg consumption low, yet a good deal could be done to stimulate consumption, at least among egg-eaters, by improving the quality of market eggs. Consumers are the ultimate judges of quality and many of them are highly discriminating in this respect. They want eggs of high quality or, in many cases, none at all.

Of the annual egg crop the larger moiety is disposed of as market eggs for human consumption and the remaining smaller fraction is utilized as hatching eggs for breeding and replenishing the flock. Market eggs reach the consumer principally in the shell and to a small extent in the dried and frozen state. Regardless of the form in which they reach the ultimate consumer, the quality of the final product depends on the original quality of freshly laid eggs and on the methods adopted in their handling and storage. Newly laid eggs are usually of excellent quality, but, being highly perishable, deteriorate rapidly if exposed to unfavourable conditions. Since no methods are known of improving the initial quality of eggs after they are laid, or of restoring quality already lost, it is of the utmost importance that the original quality should be preserved as far as possible.

In order to improve the quality of market eggs proper attention has to be paid to the numerous operations such as production, collection, testing and grading, processing, packing, storage, transport and sale. Quality in eggs may be broadly divided into two classes: (a) those relating to external factors, namely size, shape, colour, cleanliness, etc., and (b) those pertaining to internal factors, such as, colour and texture of the yolk, thickness and consistency of the white, odours and flavours, presence of meat, blood and other faults, occurrence of mould, rot, embryo development and other conditions rendering the egg inedible, etc. While the external factors can be easily judged and appreciated, it is difficult to appraise properly the internal ones due to the presence of the shell.

Exterior factors and egg quality

Consumers want eggs of good size and normal shape having a clean, smooth, sound shell and of excellent interior quality. Since most of the above factors are dependent mainly on the individuality of the bird, any improvement in the same could be brought about by the producer by keeping only a flock of good layers, selected for these qualities from a strain of known pedigree. In order to get the best out of such birds, they have to be fed, housed and managed properly, besides keeping the hygienic conditions of the farm at the highest level. Proper nutrition helps to keep up the number and size of the eggs as also their nutritive value, especially the vitamin content. The villagers, who are the main producers, being poor and ill-educated, keep whatever fowls are easily available to them. These birds are usually of unknown pedigree and, being left to shift for themselves for food and shelter, have a low efficiency. Further, due to the absence of proper management and sanitation, sickness and mortality among the flock are high and cause a further fall in production. Consequently the eggs produced are few in number, small in size, and often low in quality and dirty in appearance. The size of the egg, which is one of the most important factors requiring immediate improvement, cannot be increased till the layers now present in the villages are replaced by new stock of better

pedigree and these latter are given proper nutrition, housing and management. Under present conditions, distribution of improved stock would not be of much use as the villagers have not got the wherewithal to feed and house the birds properly and are too ignorant to attend to the proper sanitation of their houses and surroundings. Till these conditions are remedied by educating them, by improving their economic condition and by ensuring a fair return for their produce, no spectacular results can be expected. However, these measures, being of fundamental importance, need the earliest possible attention. The alternative is to start numerous well-organized largescale commercial poultry farms where adequate attention may be paid to these several factors. This procedure, though capable of yielding much quicker results than by improving village production, requires considerable capital, technical skill, practical experience and business acumen in order to make the project a success.

Cleanliness of shell is one of the important external factors which requires much improvement and immediate attention. Unlike most other external quality factors, specified earlier, this one is well within the control of the producer. It is important from the aesthetic as well as health point of view. An egg having its shell stained with blood, or coated with poultry excrement or other filth, is not only repulsive in appearance but is also a health-hazard as the contents is likely to be infected with undesirable micro-organisms. It is therefore essential that only clean eggs be produced. Providing clean litter in the nests, keeping the runs free from slush and puddles, as also confining the birds till about noon on wet days, would help to reduce the number of dirty eggs. The standard of cleanliness of the eggs sold in Indian markets is very low and provides scope for great improvement. Even after leaving the farm they become dirty by contact with filthy packing materials and the contents of broken eggs during packing and transport to the retailing centres. Adoption of measures to produce clean eggs will not only improve the quality but will also help in getting increased profit in marketing.

The colour of the shell is largely a breed factor and cannot be altered by feeding, management, or other means. Though it has no relationship whatsoever with any of the interior qualities of the egg, yet it has some importance from the sales point of view. An uniform shade in all eggs of a consignment presents a more attractive sight and thereby enhances their market value. Better results on the sales counter might be expected if eggs are sorted out into lots of uniform colour and shade.

Interior factors and egg quality

The testing and grading of eggs constitute essential and important steps in their proper marketing. These operations serve to classify them according to their exterior and interior qualities. Graded eggs fetch the maximum return to the producer and at the same time enable the consumer to have reliable and uniform products at reasonable rates. The interior quality of shell eggs is judged in commerce by a process called candling. In this, the contents of the eggs are judged by examining the eggs against a strong light, preferably in a darkened room. Experienced candlers can generally classify them according to their interior quality with a fair degree of accuracy and also eliminate most of the inedible ones without much difficulty. Except for some of the big packers of *Agmark* eggs, most of the merchants do little more than sort them out according to their size. A sort of crude candling, against the sun, may perhaps be carried out by them, but this is highly unsatisfactory and is probably the main reason for the presence of such a large proportion of poor and inedible eggs in consignments exposed for sale. It is, therefore, clear that proper candling of eggs is one of the most urgent and essential measures to be adopted if any improvement in market egg quality is to be brought about.

Among the various factors such as temperature, humidity, fertility, period of storage, cleanliness of shell, etc. influencing egg quality, temperature is about the most important. High temperature brings about rapid deterioration in eggs causing liquefaction of the firm white, flattening out and eventual rupture of the yolk, as well as increase in air cell size due to evaporation of water from the contents. In the case of fertile eggs the embryo also develops rendering them inedible in a few days. To avoid these undesirable changes and conserve the original quality to the utmost, eggs have to be kept cool, the cooler the better, the usual range of temperature employed for this purpose being about 30° to 60°F.

In this country the bulk of the market eggs are produced in the villages by the cultivators and other poorer classes of people, who generally keep a few fowls each as a side line. Usually the eggs are purchased from them by professional

egg collectors who visit the villages either daily or at intervals of a few days, according to the volume of collection available. They are then sold to contractors who are generally agents of wholesalers. These latter distribute to the retailers who, in turn, sell them to the ultimate consumers. Consequently eggs take a few days to reach the urban consumer from the rural producer. This interval has been estimated to be, on an average, about a week. During this entire period they are handled only under ordinary atmospheric conditions. Since temperatures in most parts of the plains of India for several months in the year are high, reaching up to about 120°F. in some places during the very hot months, eggs exposed to these conditions rapidly lose quality. Further, as the market eggs are usually all fertile, embryonic development also goes on apace and large numbers become inedible by the time they reach the consumer. These heavy losses, besides being a serious threat to the prosperity of the egg trade, are also highly deplorable as they constitute an unpardonable waste of a very valuable food material, particularly at this period of acute and world-wide scarcity.

Methods for improving interior quality of market eggs

The best method of ending this colossal waste and setting matters right would be to handle the eggs, as far as possible, under the requisite low temperature conditions by the use of ice or the employment of suitable mechanical refrigeration. However, the smallness of the size of the units of production, the poverty of the people engaged in the business, their low standard of education and technical skill, the lack of necessary facilities for refrigeration in most rural areas and the low price of eggs prevalent during normal times are some of the important factors which render the general adoption of the above suggested remedy impractical and uneconomic. The other obvious alternative would be to produce only infertile eggs, except during the breeding season, by removing the males from the flock. Though infertile eggs also deteriorate in quality when exposed to high temperatures, yet they remain edible for much longer periods than fertile ones under similar conditions. This apparently simple measure is also extremely difficult of largescale adoption in villages, due to the practical difficulties in keeping all the male birds of the locality segregated for several months in the year, or of killing them off wholesale at the end of the breeding season and replacing them afresh during the next. To meet these very special conditions some cheap and simple methods have been evolved in the Poultry Research Section, Imperial Veterinary Research Institute, Izatnagar, the adoption of which would go a long way to reduce markedly, if not prevent entirely, the embryo development which accounts for the bulk of the loss among market eggs during the hot weather. A brief summary of some of the important ones is given below.

Storage of eggs in egg cooler

One of these methods recommends the use of an iceless egg cooler for storing eggs. Good results can be obtained with a simple cabinet, constructed more or less on the model of a domestic meat safe, with wire netting sides and bottom. The cooling is brought about by the spontaneous evaporation of water from wetted hessian cloth suspended on all the four sides of the apparatus. These are kept continuously wet by keeping their upper ends dipping in a tray of water placed on top of the cabinet. Fertile eggs stored in such a cooler during the hot months of May and June show no marked germ development for about ten days while similar ones kept outside at the same time become rejects within about four days, showing considerable blood in the embryo. The keeping quality of the infertile eggs also was markedly improved by storage in this apparatus under the above conditions. This cooler, however, was not effective during the humid, monsoon period.

Defertilization of eggs

A better and more satisfactory process is the defertilization of the fertile eggs, which is carried out by merely keeping the eggs immersed for 15 minutes in water maintained at 55°C. This method, being very simple, can be employed by anyone with average skill at little expense. The treatment destroys the fertility of the eggs, which is the cause of such rapid spoilage, without affecting their other qualities and renders them as good as infertile ones. The defertilized eggs are equal, if not slightly superior, to naturally infertile ones in their keeping quality. Since this method does not depend on the weather or other uncontrolled external factors for its success, as in the case of the cooler described above, it can be employed in all

seasons and at all places with equal efficiency. When employing this technique, better results could be ensured by paying special attention to the following points: (a) eggs for defertilization should be carefully selected for high interior quality and soundness of shell, by proper candling, and (b) the processing should be carried out as quickly as possible after they are laid in order to retain as much of the original quality as possible and obtain the maximum benefit from the treatment. If for any reason embryonic development has proceeded too far or quality has otherwise been seriously lowered, in any lot of eggs, it would be best to reject them altogether as defertilization cannot remedy such defects and restore lost quality. Defertilization of such eggs would merely be a waste of time, labour and expense. It would be most efficient and economic to arrange for the defertilization of the eggs to be carried out at the primary points of largescale assembly. This would enable the processing to be done at the earliest practicable stage after their collection and also ensure sufficient bulk for the most efficient utilization of the available materials and facilities.

By combining both the processes, viz. defertilization and subsequent storage in the cooler, the quality of the market eggs could be maintained at a higher level for a longer period than by either process alone. In eggs which have to be transported over long distances during the hot weather, embryonic development and excessive shrinkage of contents constitute the chief causes of loss in quality. The former could be entirely prevented by proper defertilization according to the process already described, and the latter can be greatly reduced by holding the eggs in lime water for a day before despatch to the desired destination. The lime water treatment serves to seal the shell pores, through which evaporation of water takes place, thereby minimizing shrinkage.

Long term preservation of egg quality

The methods and processes described above are only suitable for reducing quality losses in fresh eggs during the few days required for them to reach the consumer in the course of ordinary marketing operations. When seasonal surpluses are held over for long periods, the maintenance of high quality becomes a very complicated problem requiring the adoption of measures for controlling losses in egg meat quality, reducing shrinkage, preventing the growth of moulds and rots, avoiding the development of cold storage taste, etc. In the modern commercial cold storage plants, where eggs are stored for long periods, elaborate precautions are taken to overcome the difficulties mentioned above by careful regulation of temperature, humidity and ventilation, the employment of gases like carbon-di-oxide or ozone, by attending to the quality and cleanliness of eggs and packing materials, and other cognate factors. These operations, however, are not of immediate practical importance in this country due to the absence of big seasonal surpluses of eggs which have to be held over in cold storage for several months and put on the market later on.

Still another method, generally employed in western countries to maintain the quality of market eggs for long periods, is oiling. In this process the eggs are just dipped and taken out of certain patented oils or other similar preservatives, like 'Oteg', which have been specially prepared for this purpose. This treatment, by coating the shell with a thin film of the oil, seals the shell pores and thereby helps to minimize shrinkage and the attendant concurrent losses in internal quality. When the eggs are fertile and temperatures high, as is prevalent in this country, not much benefit can be derived from oil dipping unless they are stored at sufficiently low temperatures. However, marked improvements could be obtained under the above conditions, even in the absence of refrigerated storage, if the eggs are defertilized before oil dipping. The drawbacks in adopting this procedure are the additional cost due to the oil and the prejudice on the part of consumers in the free acceptance of these eggs due to the greasiness of the shell. If these could be got over, the method is well worth adoption and would certainly contribute to a decided improvement in market egg quality.

Miscellaneous factors in marketing good quality eggs

Large losses, amounting up to about 50 per cent, are not uncommon in some consignments of eggs sent over long distances, due to breakage and its attendant causes. Broken eggs, besides being a total loss, cause further damage by soiling the shells of undamaged ones. Since the packing material is usually dirty and the temperature conducive to bacterial growth, putrefaction sets in. This proceeds to the cracked eggs and even to those with sound

shells. A large reduction in breakages and marked improvement in egg cleanliness and quality could be brought about by selecting a fairly rigid container and using a sufficient amount of clean, odourless, light and resilient packing material between the layers of the eggs as well as on the bottom, sides and top of the package. More careful handling of the packages is also very essential to keep down breakages to the minimum. The extra trouble and expense involved by the adoption of the above suggestions would be well worth incurring as they would be repaid several times over by the profits resulting from the savings in cracked, smashed, dirty and rotten eggs.

The rate of movement of eggs from the farm to the market also needs considerable speeding up. More frequent collection of eggs from the villages would ensure their quicker assembly and if they are tested and graded as well as processed and packed with the utmost expedition, much unnecessary loss of quality could be avoided. It often happens that eggs in transit lie on station platforms, exposed to sun and rain for hours on end, sometimes even for a whole day or more, before being sent on to their destination. These delays should be eliminated and egg packages must be recognized to contain highly perishable material which need the quickest possible transit facilities as well as more careful storage and handling *en route*.

Since eggs rapidly pick up odours and flavours from the surroundings, and as there is no method of detecting this fault till they are broken out, they must not be stored near strong smelling articles like fish, onions, kerosene, etc.

By recognizing that the egg is a valuable foodstuff which is highly perishable, and needs special care and attention in all the stages of production and marketing, and by adopting one or more of the methods suggested above, a decided improvement in market egg quality could be brought about in a comparatively short time, even under the existing unfavourable conditions.

BEDBUGS ARE ALSO POULTRY PESTS

USUALLY considered only as a pest to man, the common bedbug and several other allied species are often troublesome to poultry. Only at night when a blood meal is required, the bugs search out their victims, and at other times secrete themselves in cracks and crevices. Small, elongated white eggs are deposited in these hiding places, up to 200 eggs being laid by each female. The young bugs produced from these eggs are similar in appearance to the adults but are paler in colour, their only food like that of the adults being blood. They can live, however, for several months without a meal. The life-cycle from egg to adult may be completed within six weeks but is often much more prolonged. One of the simplest and most satisfactory control measures for infested chicken houses is to spray all cracks and crevices in woodwork and roosts with creosote oil or crude petroleum. If complete eradication is not effected by this treatment, it should be repeated after about ten days.—*Department of Agriculture*, Canada, January 16, 1946.

TREES AND THEIR HABITAT

M. S. Randhawa

Secretary, Imperial Council of Agricultural Research

BIOAESTHETIC planting of ornamental trees has a close relation with plant ecology. Study of ecology is essential for the bioaesthetic planner. He must place plants in habitats which approximate to their natural surroundings. The texture of soil, amount of rainfall, presence of rivers, canals and tanks, and temperature play an important role in the growth of trees. There are certain trees which flourish only in moist districts with a rainfall of over 40 in., or along the banks of rivers, canals and tanks. In districts with less rainfall, these trees can grow if artificial means of irrigation are available, but they never acquire the same stature as in moist areas. This does not mean that such trees should not be grown at all in dry areas. If means of irrigation are available these may be grown. A dwarfing in size takes place when trees which are inhabitants of moist districts are grown in dry areas, and this is an advantage when considered from the point of view of the owner of a small compound. *Lagerstroemia flos-reginae* which is a big tree in Bengal, is a medium-sized tree in the Punjab and the United Provinces. The trees which are suited for moist localities are shown in Table I.

A careful scrutiny of Tables I and II shows that out of 20 trees we have selected for moist areas, there are 12 which are natives of foreign tropical countries with heavy rainfall and high humidity.

On the other hand out of the list (Table II) of selected ornamental flowering trees, there are 14 trees which can stand drought and shortage of water. These are trees with special structural modifications which enable them to cope with dry conditions, heat and shortage of water. Some of them have long roots and waxed leaves which check evaporation of water. Out of these there are 10 trees which are indigenous and thus ideally suited for dry tracts of our country. These trees with xerophytic features can flourish in dry areas where irrigation facilities are poor and hot dry winds check the growth of trees. These trees can tolerate arid conditions, but this does not mean that they love drought and heat. They can grow in moist districts as well and do very well indeed.

Moisture-loving trees

However, when we have to plant the banks of a canal, a river or a tank, we should select moisture-loving trees only, such as *Lagerstroemia flos-reginae, Salix tetrasperma* (willow), and *Sapium sebiferum* (*makhan*). The last one which is also known as the Chinese Tallow Tree is a medium-sized deciduous tree whose leaves display lovely autumn tints and is used for stream training in Kangra and Jhelum districts.

There are very few trees which can grow in marshy waterlogged areas. *Eucalyptus rostrata* has proved a success in waterlogged areas near the Upper Jhelum canal in the Punjab. Willows and *Tamarix* are also suitable for such areas. Where adequate protection against animals is available bananas may also be tried. These trees can also be used for draining puddles which form near wells in our villages. It is suggested that these puddles should be enclosed with brick-walls to protect the young trees from cattle, and planted with the trees mentioned above. Where the soakage pits have failed to drain, these trees might succeed.

Soil

Soil plays a very important role in the life of trees. High, well-drained soil of mixed sand and clay is ideal for the growth of trees. Waterlogged, low-lying areas produce stunted growth. There are certain trees which can flourish in poor sandy soil. These are mostly members of the family Leguminosae whose roots harbour nitrifying bacteria in tubercles which fix atmospheric nitrogen and make it available to the tree. Then there are trees which can cope with alkaline soil, such as *Butea frondosa*, the common *Dhak*. In fact trees serve as a valuable index of the type of soil on which they grow. Further there are trees which can grow on dry rocky areas with minimum of soil, such as *Cochlospermum gossypium, Cassia fistula, Prosopis juliflora* and Plumerias. These trees are ideally suited for covering arid hills such as those found in Central India and Rajputana.

Animals, particularly goats, are the chief enemies of young trees. Some trees like *Cassia fistula* contain chemicals in their sap, and that is why goats, cows and buffaloes will not touch the leaves of *Amaltas*, which have a purgative action on their digestive organs. Hence *Amaltas* is well-suited for planting waste-land which cannot be protected from grazing animals.

Tropical trees and frost line

Frost Line may be described as an imaginary line which passes through districts below which frosts never occur. Roughly this line extends from the sub-Himalayan districts of the United Provinces to the eastern districts of the Punjab. From our point of view the significance of this line lies in the fact that majority of the denizens of the equatorial and monsoon forests are unable to flourish in areas above this line. Given sufficient protection in winter they may grow in the area above this line, but these trees are quite *unable to reproduce themselves* in areas where frost occurs. This explains why *Colvillea racemosa* produces so few seeds even in the United Provinces. Out of trees we have listed as suitable for moist localities, there are 12 trees which are natives of tropical countries like Africa, Madagascar, Java, West Indies, Malaya and Burma. These trees cannot be satisfactorily grown in the Punjab, North-West Frontier Province, Kashmir and the Himalayan zone. In this matter the United Provinces of Agra and Oudh, Bihar, Bengal, Madras and Bombay provinces are more fortunate and the choice of trees available for planting is larger as compared with the northern area above the frost line. In these areas only indigenous trees which are adapted to our climate are indicated, and it would be futile to grow Pink Cassia, Colvilleas and Gul Mohurs at Lahore and Peshawar.

TABLE I

List of ornamental flowering trees suited for moist localities

	Name of Tree	Country of origin	Time of flowering	Colour of flowers
1.	*Amherstia nobilis*	Burma	March	Golden-yellow
2.	*Bauhinia variegata*	India	March- April	White, pink or mauve
3.	*B. purpurea*	West Indies	February-March	Scarlet-red
4.	*Brownea coccinea*	do.	do.	do.
5.	*B. ariza*	do.	do.	Rose-pink
6.	*Cassia marginata*	Ceylon	May-June, and October	Terra-cotta red
7.	*C. javanica*	Java	do.	Rose-pink
8.	*C. nodosa*	Eastern Bengal and Malaya	do.	Bright-pink
9.	*Colvillea racemosa*	Madagascar	October-November	Scarlet-orange
10.	*Guaiacum officinale*	West Indies	March-April	Blue
11.	*Lagerstroemia flos-reginae*	Bengal	April-May and July-September	Mauve-purple
12.	*L. Thorelli*	India	do.	White-mauve
13.	*Milletia auriculata*	Burma	March	Purple-mauve
14.	*Poinciana regia*	Madagascar	April-June	Scarlet-orange
15.	*Peltophorum ferrugineum*	Malaya	October	Golden-yellow
16.	*Pitheclobium saman*	Brazil	March and September	Pale-pink
17.	*Saraca indica*	India	February-March	Scarlet-orange
18.	*Solanum wrightii*	Brazil	All the year round: particularly in October	White, and Purple-blue
19.	*Spathodea campanulata*	Tropical Africa	February-March	Orange-red
20.	*Sterculia colorata*	South India	April-May	Orange-red

TABLE II

Ornamental flowering trees suited for dry localities

Name of Tree	Country of origin	Time of flowering	Colour of flowers
1. *Acacia auriculiformis*	Australia	October-November	Yellow
2. *Butea frondosa*	India	March	Orange
3. *Cassia fistula*	India	April-May	Yellow
4. *Cordia sebestena*	South India	All the year round particularly January to March	Scarlet-orange
5. *Cochlospermum gossypium*	do.	March	Yellow
6. *Erythrina indica*	India	February-March	Scarlet-red
7. *E. Blackeii*	India	April	Cinnamon-red
8. *Jacaranda mimosaefolia*	Brazil	March-April	Violet-blue
9. *Melia azedarach*	Punjab (India)	April	Lilac
10. *Plumeria alba*	South America	March-April, July-October	White
11. *Pongamia glabra*	India	May	Mauve
12. *Spathodea nilotica*	Tropical Africa	February-March	Orange-crimson
13. *Tecomella undulata*	North India	March-April	Orange-yellow
14. *Thespesia populnea*	India	All the year round; particularly in October and November	Yellow and Reddish-purple

TABLE III

List of drought-resistant trees suitable for arid regions

Albizzia lebbek	*Siris.* A deciduous, spreading, fast-growing tree, 40 to 60 ft. high. Thrives in the Punjab, Rajputana and South Persia. Moderately drought-resistant.
Butea frondosa	*Dhak* or *Pulas.* A medium-sized deciduous tree, gets covered in March with scarlet flowers. Extremely resistant to drought.
Cassia fistula	*Amaltas.* A medium-sized deciduous tree, 30 to 40 ft. high. Gets covered with golden-yellow flowers in May.
Casuarina equisetifolia	*Beef-wood Tree.* A tall evergreen tree; 50 to 60 ft. high; with long needle-like leaves; native of Australia, grows well on dry sandy soil. Thrives in the Punjab.
Eucalyptus citriodora	*Safeda.* A tall evergreen tree; thrives in the Punjab and Iraq.
Melia azedarach	Persian Lilac, *Dake, Bakain.* Deciduous tree, 20 to 40 ft. high. Purple panicles in March. Flourishes in the Punjab.
Morus indica	Mulberry, *Toot.* Thrives in the Punjab, Syria and South Persia.
Phoenix dactylifera	Date-palm, *Khajoor.* Flourishes in Western Punjab, Persia and Iraq.
Prosopis Juliflora	Mesquit Bean. A deciduous tree, medium sized, graceful feathery foliage. Of quick growth, extremely drought-resistant, a native of Mexico.
Salvadora persica	*Pilu,* Mustard Tree of Scripture. A small evergreen tree with small oval-fleshy leaves. Extremely drought-resistant, flourishes in Western Punjab and Persia.

TABLE IV

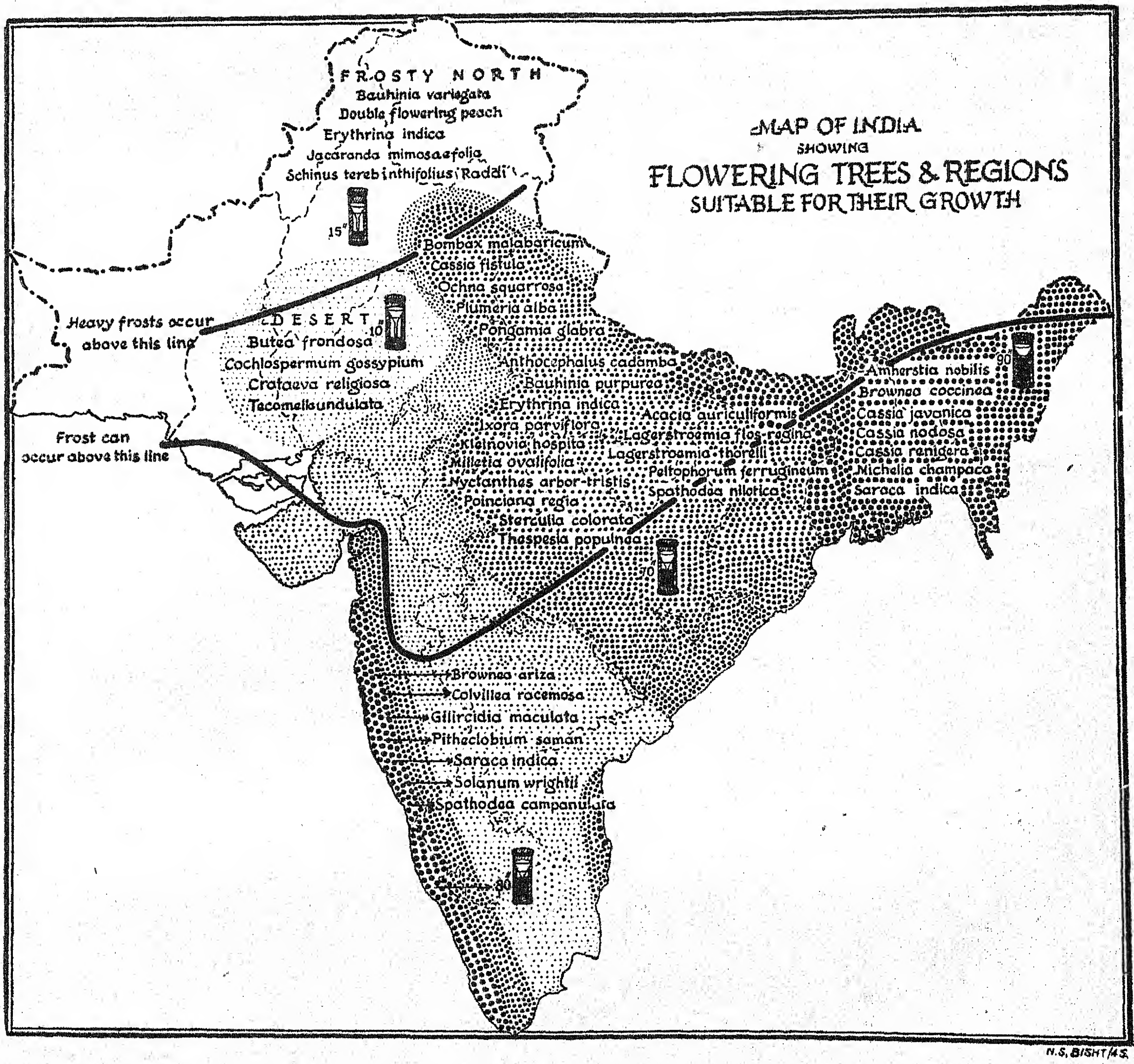
List of salt-resistant trees

Butea frondosa	*Dhak, Pulas.* Extremely salt-resistant, in fact, the only tree which grows successfully on saline, *usar* and *kalar* soil.
Bassia latifolia	*Mahua.* Moderately salt-resistant, can grow on slightly saline soil. Yields good timber and edible fruit which can be fermented into liquor.
Eucalyptus citriodora	Moderately salt-resistant. Grows even in Iraq.
Azadirachta indica	*Neem.* Moderately salt-resistant.
Phoenix dactylifera	Date-palm, *Khajoor.* Flourishes in brackish soil.
Phyllanthus emblica	*Amla.* Flourishes in slightly saline soil.
Psidium guava	Guava. Can easily grow in mild *usar.*
Tamarix articulata	*Farash.* Thrives in arid saline soil.

TABLE V

List of trees for swamps and marshy areas

Eucalyptus rostrata	Has a high rate of transpiration and is useful for draining marshy areas.
Salix tetrasperma	Willow. Ideal tree for water-side planting.
S. babylonica	do.
Tamarix sp.	*Farash.* Can stand waterlogging.
Plantains	*Kela.* Its broad leaves have a high rate of transpiration.



MAP OF INDIA
SHOWING
FLOWERING TREES & REGIONS
SUITABLE FOR THEIR GROWTH
FROSTY NORTH
Bauhinia variegata
Double flowering peach
Erythrina indica
Jacaranda mimosaefolia
Schinus terebinthifolius Raddi
15"
Heavy frosts occur above this line
DESERT
10"
Butea frondosa
Cochlospermum gossypium
Crataeva religiosa
Tecomella undulata
Frost can occur above this line
Bombax malabaricum
Cassia fistula
Ochna squarrosa
Plumeria alba
Pongamia glabra
Anthocephalus cadamba
Bauhinia purpurea
Erythrina indica
Ixora parviflora
Kleinovia hospita
Milletia ovalifolia
Nyctanthes arbor-tristis
Poinciana regia
Sterculia colorata
Thespesia populnea
Acacia auriculiformis
Lagerstroemia flos-regina
Lagerstroemia thorelli
Peltophorum ferrugineum
Spathodea nilotica
70"
Amherstia nobilis
Brownea coccinea
Cassia javanica
Cassia nodosa
Cassia renigera
Michelia champaca
Saraca indica
90"
Brownea ariza
Colvillea racemosa
Gliricidia maculata
Pithecolobium saman
Saraca indica
Solanum wrightii
Spathodea campanulata
80"
N.S. BISHT/45.

PLATE 24

TABLE VI

Nectar-yielding trees

1. *Bauhinia purpurea*
2. Bottle brush (*Callistemon lanceolatum*)
3. Horse Chestnut (*Aesculus indica*)
4. *Jaman* (*Eugenia jambolana*)
5. *Kachnar* (*Bauhinia variegata*)
6. *Neem* (*Azadirachta indica*)
7. *Sheeshum* (*Dalbergia sissoo*)
8. Soapnut (*Sapindus*)
9. *Tun* (*Cedrela tuna*)
10. *Barna* (*Crataeva religiosa*)

TABLE VII

Fodder trees

Toot (*Morus alba*)
Kachnar (*Bauhinia variegata*)
Peepal (*Ficus religiosa*)
Neem (*Azadirachta indica*)
Babul (*Acacia arabica*)
Haldu (*Adina cordifolia*)

OLIVE TREES

THERE are about 300 varieties of olive trees from which olives and olive oil are obtained ; the oil content depends not only upon the variety but upon soil and climatic conditions.—*Science News Letter*, April 20, 1946.

DEVELOPMENT OF FISHERIES IN THE PUNJAB

I. CONSERVATION

HAMID KHAN, M.Sc., LL.B.(Punjab), PH.D.(Cantab), F.A.Sc., F.N.I.
Warden of Fisheries, Punjab

THE Punjab, with its large rivers and their tributaries, a network of canals, a number of tanks and ponds, has a fairly large fresh water area with vast resources for the development of fresh water fisheries. The rivers, namely the Indus, the Jhelum, the Chenab, the Ravi, the Sutlej, the Beas and the Jumna and their tributaries, despite the shortage of water supply in most of them during winter and summer due to the demand of irrigation, are capable of yielding fresh water fisheries of considerable value. The fisheries of all the rivers, streams and canals are public and State-owned and are, therefore, amenable to control and capable of development.

As early as 1871, Dr Day[1], in his report on *Fish and Fisheries of the Freshwaters of India and Barmah* quoted the reports received from District Officials in the Punjab regarding the wasteful destruction of the fish, especially of young fish by means of purse nets of small mesh. It was, however, in 1911 that the Punjab Government, realizing the diminution of the fish supply of the province, appointed Mr Dunsford on special duty to enquire into the causes of diminution. As a result of the enquiry, Mr Dunsford[2], attributed the diminution to three principal causes of destruction, namely:

1. The obstruction of the passage of migratory fish to their natural spawning grounds.
2. The wholesale destruction of fish, large and small, caused by canal closures.
3. Excessive poaching, especially in hill and submontane rivers involving indiscriminate slaughter of breeding fish and fry.

Remedies suggested by Mr Dunsford were as under:

1. The construction of suitable fish passes at all the headworks of the canals for the passage of fish to their natural spawning grounds.
2. The construction of reservoirs in or adjoining canals to save large and small fish from wholesale destruction during canal closures.
3. The prohibition of the use of 'fixed engine', which according to Indian Fisheries Act, 1897, means 'any net, cage, trap, or other contrivance for taking fish, fixed in the soil or made stationary in any other way'.
4. The licensing of nets, and confining their use to those castes which are, and have been for ages, professional fishermen; in other words, the establishment of licensed fisheries.
5. The imposition of a close season.
6. The adoption of methods by which production may be increased, by protecting the ova of breeding fish, and by safeguarding the young and helpless fry from the many dangers which threaten them.

Soon after the enquiry, the Fisheries Department came into existence in 1912 as a temporary measure, and was made permanent in 1916. From its very inception, therefore, the Department started its activities with the main objects of, *firstly*, conservation, *secondly*, the development of the fisheries of the province by culture and propagation, and *thirdly* marketing or exploitation.

Conservation

The conservation measures adopted in the Punjab are:

1. Conservation by legislation.
2. The creation of sanctuaries to protect the breeding grounds of the fish.
3. The construction of fish ladders or fish passes at the canal head-works to facilitate the movements of fish to their natural spawning grounds.
4. The destruction of fish enemies.

Legislation: The Punjab, of all the provinces of India, is probably the only province that possesses almost a complete set of rules and regulations for the conservation of fisheries. There are two acts in force in the province, namely:

(i) The Indian Fisheries Act, 1897, Act IV of 1897, and

(ii) The Punjab Fisheries Act, 1914, Act II of 1914, as amended by Act IV of 1923 and Act II of 1941.

[1] Day, F. (1873). *Report on the Fish and Fisheries of Fresh Waters of India and Barmah*, Simla.

[2] Dunsford, H.S. (1911). *Report on the Fish and Fisheries of the Punjab*, Punjab Government Press, Lahore.

Rules have been notified under both the Acts.

The Indian Fisheries Act prohibits the use of poisons and dynamite in rivers with intent to catch or destroy any of the fish that may be therein under the penalty of imprisonment for a term which may extend to two months, or with fine which may extend to two hundred rupees. The Act gives powers to Provincial Governments to make such rules as might seem necessary for protection of fish in waters under their jurisdiction by prohibiting and regulating

(a) the erection and use of 'fixed engines',

(b) the construction of weirs,

(c) the dimensions and kind of the nets to be used and the mode of using them, and

(d) prohibition of all fishing in any specified water for a period not exceeding two years; in other words the creation of sanctuaries for the fish.

The Punjab Fisheries Act, 1914 and the rules notified thereunder

(i) prohibit fishing except under a licence, and regulate the granting of such licences, the fees payable therefor and the conditions to be inserted therein,

(ii) prescribe seasons in which the killing of any fish of any prescribed species shall be prohibited,

(iii) prescribe a minimum size or weight below which no fish of any prescribed species shall be killed,

(iv) authorize any person empowered by Provincial Government to arrest without warrant any person committing in his view a breach of any rule made under the Act,

(v) empower Fishery Officers to compound a fishery offence by accepting a sum by way of compensation not exceeding rupees ten for each offence, and

(vi) prescribe punishment for the offences under the Act and under the Rules, which may extend to a fine of one hundred rupees.

There is a separate agency in the Punjab, consisting of the Warden, Deputy Wardens and Assistant Warden of Fisheries, to enforce the provisions of both the Acts and the Rules notified thereunder.

The Indian Fisheries Act and the Punjab Fisheries Acts and the rules notified thereunder have undoubtedly checked to a large extent the appalling diminution of the fish supply of the province by preventing the wholesale destruction of the fish, young and adult, in and out of season. Before the Fisheries Regulations came into force, there were innumerable methods of capturing fish, and most of these appeared to have been devised for the express purpose of allowing nothing, however small, to escape. Some of the most harmful methods which have been instrumental in diminishing the supply of fish of the province are:

(i) Poisoning, by using of such poisons as lime, juice of cactus, etc.,

(ii) dynamiting,

(iii) the use of fixed engines,

(iv) the diversion of water for killing fish,

(v) erection of dams, weirs and traps for killing fish, and

(vi) continuous netting with small meshed nets.

With the introduction of legislation fishing has been brought under control, and it is permitted only under a licence with nets which have a mesh of 3 in. (= $1\frac{1}{2}$ in. wall length from knot to knot making a perimeter of 6 in. all round) in the plains and $2\frac{1}{2}$ in. mesh or 5 in. perimeter all round in the hills so as to allow the young fish to escape. The use of 'fixed engines' is prohibited, excepting the use of those which were sanctioned before the settlements preceding the year 1904, but under a licence and with the condition that the interstices of the wickerwork or the mesh of the nets used in the fixed engines are of regulated size so as to allow the young fish to escape. Poisoning and dynamiting is totally prohibited and the erection of dams and weirs is regulated under the Indian Fisheries Act, 1897. For the conservation of fisheries, licensing of fisheries is a wise step in right direction.

Sanctuaries: Creation of sanctuaries is another important measure of conservation of our fisheries. Under the provisions of Section 6 of the Indian Fisheries Act, 1897, 24 sanctuaries have been created and notified in the various districts of the Punjab where fishing of all kinds is strictly prohibited. Most of these sanctuaries exist in the spawning grounds of important species of fish and also in such stretches of waters where owing to religious scruples the killing of fish is prohibited. Some of the best spawning grounds of *mahsir* in Kangra and of other carps in the plains are thus legally protected.

In addition to sanctuaries, fishing near canal headworks within a distance of $\frac{1}{4}$ to $\frac{3}{4}$ mile up and downstream is restricted to rod and line only, thus affording protection to the fish that congregate near the headworks from wholesale destruction by netting.

Fish ladders: With the development of irrigation projects in the Punjab, dams and weirs

have been constructed in the form of masonry works at the headworks of the canals for the purpose of deflecting the water into the canals. These weirs run across the entire width of the river and thus obstruct both the up and the downward passage of the fish. In order to enable the fish to ascend the headwaters of the rivers and thus reach their spawning grounds for propagation or to allow their migratory habits in search of food, fish passes or fish ladders have been constructed in the weirs. The underlying principle in the construction of fish passes is the retardation of the current velocity of a waterfall so as to enable fish to surmount it. The under-sluices or the openings of the weir carry such a rush of water through them that no Indian fish can ascend the river when they are open.

Of all the provinces in India, to the Punjab belongs the credit of providing fish passes on almost all the headworks of the canals for the passage of the migratory fish to their natural spawning ground or fresh feeding areas. There are 14 weirs in the Punjab and 12 of them have got fish ladders, constructed at a cost of over 6½ lacs of rupees. It is, however, a matter of regret that most of the fish ladders have so far proved ineffective, as majority of them are not fish ladders but mere fish traps for catching fish. The main defects are: (i) most of them are too steep or too narrow, (ii) the upstream inlets are generally too severe to allow the smaller species of the migratory fish to ascend, (iii) the downstream openings in most cases are too small and too inconspicuous to be perceived by the ascending fish, (iv) there is hardly any pool at the entrance of the ladders where fish could collect before ascending, and (v) the water supply in most of the ladders is not available during the periods when the fish migrate.

Destruction of vermins : Some of the principal fish enemies in the Punjab are:

(i) Crocodiles. These are of two varieties, the blunt-nosed *muggar* and pointed-nosed *gavial* or *garial*. The latter is said to be more destructive to fish than the former.

(ii) Otters. These are reported to have done considerable damage to fisheries, especially the trout nurseries. They are wasteful feeders and kill the fish for the pleasure of killing and not for consumption alone.

(iii) *Fish-eating Birds*, namely:

(a) Cormorants. They do enormous damage to a fishery. They prey in company. Twenty to thirty birds get down on a stream, swim in a row and by flapping their wings make a noise to drive the fish to shallow water where they set upon them and devour them in large number. A cormorant is said to eat fish almost double the weight of its body.

(b) Fish-eagle. It is one of the most dangerous enemies of the fish. It can easily carry a two-three pounder in its claws, while a heavier fish is consumed on the bank of the river. At one of our fish farms, fish eagle invariably carried one or two fish every day.

(iv) Predaceous fish. Some of the predaceous fish, namely *mullee* (*Wallagonia attu*) and *goonch* (*Bagarius bagarius*) are rightly termed fresh-water sharks as they do inconceivable damage to the fisheries and devour even big-sized fish without any hesitation. The presence of predaceous fish in a pond, where carp have been stocked, is as dangerous as that of cat in the pen of hens.

(v) Frog. It is a great spawn and fry eater. It has been seen devouring carp fry of one inch in length in large number.

The destruction of fish enemies should be the foremost duty of a fishery owner and of fishery officials, as otherwise the result of stocking of ponds and tanks would very often be disappointing. The Department of Fisheries in the Punjab, therefore, offers the following rewards for the destruction of the fish vermins:

Crocodile over 8 ft. in length Rs. 3 per animal
Crocodile, 8 ft. or less than 8 ft. in length. Re. 1 per animal
Crocodile eggs. One anna per egg
Otter. Rs. 2 per animal
Cormorants and fish eagle. Four annas per bird

A PALM SUITABLE FOR CULTIVATION IN INDIA
BACTRIS UTILIS BENTH. et HOOK. F.

A. C. Joshi
Professor of Botany, Government College, Lahore

INCREASED food production is the first item in one and all plans aiming at the future development of this country. That alone can give the nation a higher level of health and of working efficiency. It has been estimated that our minimum requirements in this direction, in order to be able to feed a population of 400 million, are 10 per cent increase in the production of cereals, 20 per cent increase in the production of pulses, 250 per cent increase in the production of fats and oils, 50 per cent increase in the production of fruits and 100 per cent increase in the production of vegetables, besides 300 per cent increase in the production of milk, fish, flesh and eggs[1]. This goal can be reached only by a very determined march towards it simultaneously from several different directions. What requires to be done in this connection is already well known and need not be repeated here. The botanist believes that a good deal can be accomplished by introducing suitable plants from foreign countries, which can be grown without interfering with our present crops. This will be helpful not only in increasing the quantity and variety of food produced in this land, but can also contribute to the recovery of some of our waste lands.

Tropical and sub-tropical America has already given us many of our common food plants, but there are still several others that can be introduced into India from that continent. Among such, the palm *Bactris utilis* Benth. et Hook. f. (Syn. *Guilielma utilis* Oerst.), known in Costa Rica by the name of *pejibaye*, which has been characterized as the tropical American counterpart of the oriental date palm, appears to deserve our immediate attention.

A strong plea for the wider cultivation of this palm in tropical countries was made by Popenoe and Jimenez[2] more than 20 years ago. They wrote, 'The relatively small proportion of water contained in the fruit; the large amount of carbohydrates (mainly starch); the considerable quantity of fat; and the small size of the seed compared to the bulk of the edible portion, combine to place the *pejibaye* among the most noteworthy of the tropical fruits. And it is not only a fruit of high food value, but it is delicious as well. We believe that it is destined to become a food plant of great importance in many tropical countries . . . . . We wish to urge upon horticulturists in tropical regions, where this palm is not yet cultivated, the desirability of its introduction and establishment as a common dooryard tree with a view, later, to the extension of its culture, so as to place the *pejibaye* upon the substantial basis of a profitable commercial fruit, a position which we confidently predict it will achieve if the necessary initiative is supplied to effect its preliminary planting and study'. Unfortunately this has hitherto received no attention in our country, but now that the food problem is very much in our minds, we may consider again what has been previously stated by the above authors.

Description

Bacteris utilis is a tall slender palm, up to 60 ft. high. It is topped by a crown of large, very graceful, pinnate leaves, 8 to 12 ft. long. The stem, which is about six inches in diameter, is marked into rings due to alternation of transverse bands of smooth surface with zones covered with stiff, very sharp black spines about two inches long. The rachis of the leaves is also armed with scattered spines. The racemes are 18 to 24 in. long, stout and are borne on the trunk either immediately below or among the lower leaves. The male and female flowers are both found in the same racemes. The fruits mature in 4 to 5 months after flowering. The ripe fruits are 1 to 2 in. long, light yellow to orange or reddish orange or rarely brownish in colour, ovoid, top-shaped or conical, and covered at the base by the green, leathery, 3-toothed, persistent calyx. They possess a thin skin, a dry, mealy, yet firm flesh, and a single, black, conical seed, about $\frac{3}{4}$ in. long.

[1] Afzal Hussain, M. (1946). *The Food Problem of India. Presidential Address*, 33*rd Indian Sci. Cong.*

[2] Popenoe, W. and Jimenez, O. (1921). *The Pejibaye, a Neglected Food-plant of Tropical America. J. Hered.*, **12**, 154-166

There is also a seedless variety of the *pejibaye*, named in Costa Rica as *pejibaye macho*. This is a fine large fruit entirely devoid of seed.

Distribution and local names

Bactris utilis has been cultivated in Costa Rica from a very early period. It is also grown in the lowlands of Colombia, Venezuela and Ecuador. It has been cultivated for such a long time that its exact original home like that of many other cultivated plants is difficult to guess. Some of its local names are as follows: Costa Rica—*Pejibaye*; Ecuador—*Chontaduro* or *Chontaruru*; Colombia—*Gachipaes, Cachipaes* or *Cachipay*; Venezuela—*Pirijao.*

Propagation

Propagation is affected most commonly by seeds. These, if grown under suitable conditions, germinate in about two months and the plants begin to bear fruit at the age of 6 to 8 years. In plantations, the palms need to be spaced 20 ft. apart. Two to four suckers are usually allowed to develop around the base of each. This gives rise to clumps of 3 to 5 stems.

The second method of propagation is by suckers. This is the only method of propagation in the case of the seedless varieties, which are really the best. The most suitable time for the removal of the suckers is when these are 4 to 6 ft. high. At this time they are about three inches thick at the base and have already formed roots. They can be easily separated from the parent palm and established independently. The necessary precautions are that the leaves should be heavily cut back and the plants should be shaded and given plenty of water until the new roots are formed. Generally 8 to 10 suckers can be had from one palm.

Harvesting, yield and marketing

A remarkable feature of the fruits of the *pejibaye* is that they can remain on the palm in good condition for a long time even when ripe. Their collection presents some difficulties on account of the presence of sharp spines on the trunk of the palm. They are generally gathered with the help of a ladder when the whole raceme is cut or the individual fruits are simply knocked down by means of a long pole.

A raceme of mature fruits weighs approximately 25 lb. As one palm produces on an average five or six such racemes in a year, it yields approximately 150 lb. of fruits per annum.

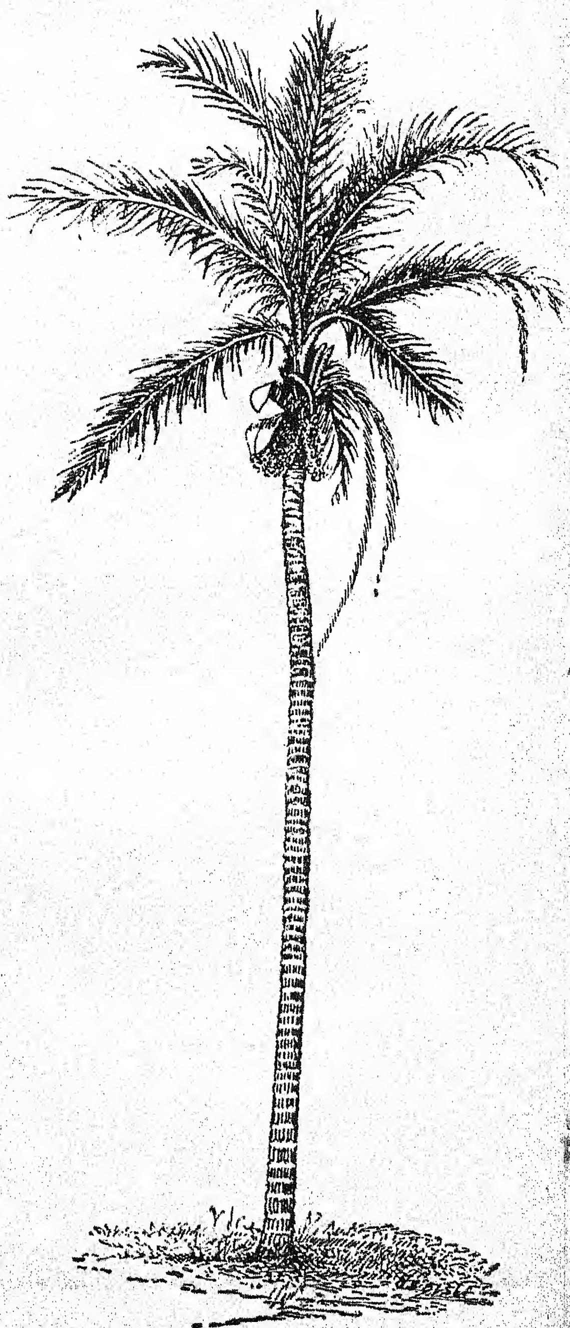
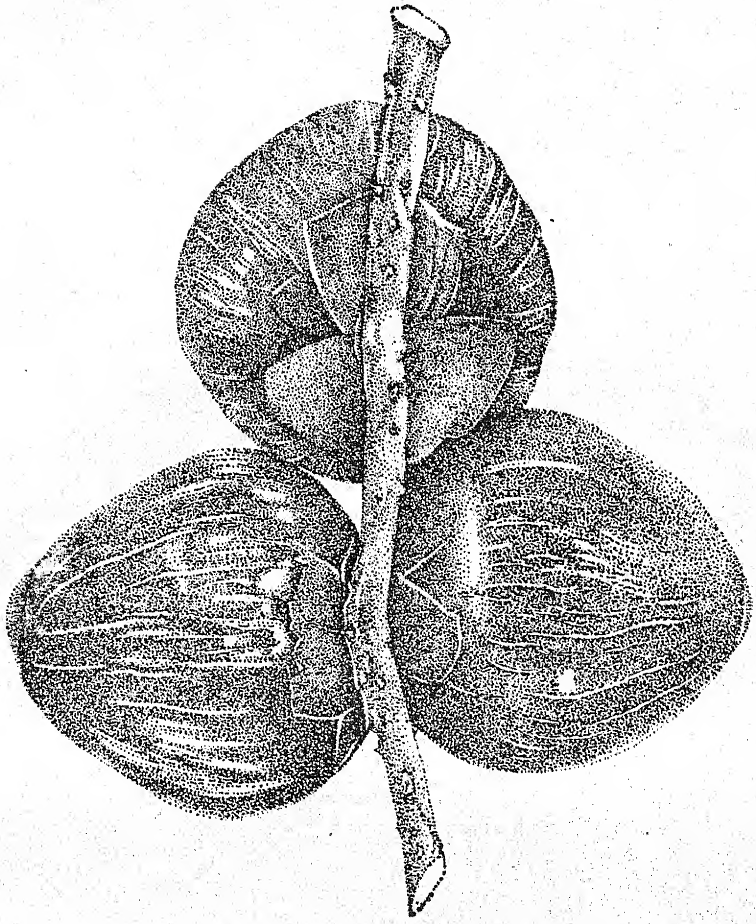
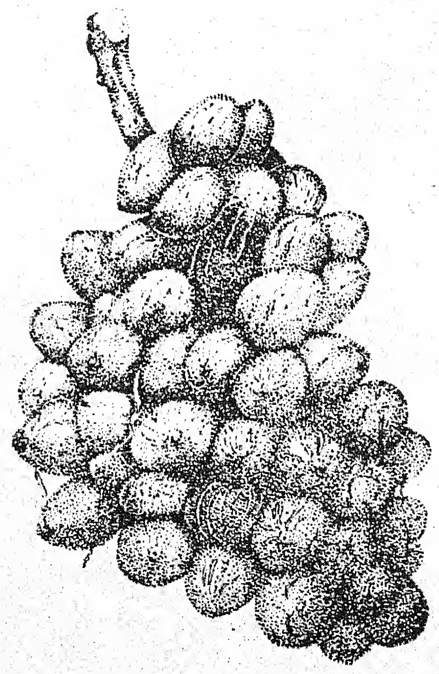


Fig. 1. The *pejibaye* palm (*Bactris Utilis*)



The fruit of *pejibaye* palm

PLATE 25



A raceme of seedless *pejibaye*

PLATE 26

The marketing of *pejibaye* is a comparatively simple affair. If properly packed, they easily keep for 10 to 14 days without any appreciable change either in appearance or flavour. It is also possible to dry the boiled fruit. It can then be kept for an indefinite period. Fruits stored like this for six months have been found to be as good as the fresh ones.

Composition

The ripe uncooked fruits contain 26·9 per cent of starch, 4·0 per cent of sugar and 5·8 per cent of fat. Their calorific value is the highest among the tropical fruits of economic value.

Uses

The fruits are generally eaten after boiling in salted water for about three hours and removing the skin. The small seed separates readily from the flesh and gives no inconvenience. The fruit closely resembles chestnut in texture and flavour, and has a very agreeable taste. Dried, it can be made into flour. The white kernel of the seed is also edible. It is rich in oil and has the flavour of coconut. The terminal bud can be eaten as a vegetable. The wood is dark brown, very hard and takes a fine polish. It is used for making walking sticks.

Suitable areas for cultivation in India

It can be inferred from its present distribution that *Bacteris utilis* is adapted to moist tropical regions with an annual rainfall of 100 in. or less. It can grow from sea-level to up to about 4,000 ft. South India, Orissa, Bengal and Assam appear to be the provinces where it could be cultivated to great advantage. It would be best to introduce this palm as a courtyard tree. Five or six palms grown around each hut in the village, and even in the compounds of the houses in towns and cities, at practically no cost, would annually yield about 10 md. of very wholesome and palatable food. And this would be available for approximately six months. There appears to be no doubt that if this palm could be successfully established in our country, it can materially add to our food resources without displacing any other crop. It would just give us extra food, from where we get at present nothing.

DRYING FRUIT BY SEARCHLIGHT

AN attempt is being made in Australia's Murray Valley—rich irrigation country—to dry vine fruits by searchlight, because dehydration plants cannot cope with the crop. Weather conditions have drastically restricted the usual sun-drying operations.

A complete army mobile searchlight unit was rushed from Seymour military depot, Victoria, to Redcliffs, following a request from the Federal Minister for Agriculture, Mr Scully, to the Minister for the Army, Mr Forde. The experiment with searchlight drying is being conducted by officers of the Council for Scientific and Industrial Research, in cooperation with growers.

The estimated total Australian harvest of grapes has already been reduced to 70,000 tons by weather conditions. A normal harvest amounts to 105,000 tons, 90 per cent of which comes from the Murray Valley. Of the 70,000 tons, 51,000 tons was earmarked for Britain, but only 40 per cent could be sun-dried.—*Australian Agricultural Newsletter*, Release No. AGN/130.

BLOOD MEAL

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MEN, poultry and swine are omnivorous animals. Many of India's millions habitually have a diet approaching the vegetarian, but even the most orthodox Hindu admits the necessity of milk or milk products in the diet if one is to maintain his health and strength through an otherwise vegetarian diet.

Animal products in diets

The main necessity for animal products in this diet is the need for supplying essential amino-acids which are not found in the plant proteins. The cow, horse, goat, sheep, rabbit and elephant require animal protein in their extreme youth only. After a few months they are weaned from their mother's milk and from that time onwards subsist on a completely vegetarian diet. Some animal husbandmen in India try to raise their poultry and swine on a diet that does not provide sufficient animal products. If a few hens are kept and are allowed free range they can usually find enough worms and insects to balance their diet; if, on the other hand, large numbers of fowls are kept in confinement, adequate provision must be made for a supplementary protein concentrate of animal origin. Many substances have been used successfully and poultry-keepers throughout the world recognize the value of milk products, fish meal, meat meal, tankage and blood meal in the diet of fowls. In India many householders buy offal from the butcher and after cooking it chop it up and feed it to their poultry. The main drawbacks in the use of this product are that it is often difficult to secure sufficient of the material, that it is sometimes difficult also to get the material in a fresh state, that considerable effort is necessary to prepare it for the fowls and that the material is of poor keeping quality. One reason why so little animal protein is used in the diet of men and omnivorous animals in India is because this is usually the most expensive item of the diet. Another drawback is that these animal products are the most difficult of all foods to keep fresh and palatable.

Here at the Agricultural Institute we formerly used skimmed milk, whey, buttermilk and offal for our poultry. Upon starting our piggery and enlarging our poultry enterprise, we were soon faced with a shortage of animal products for feeding; therefore, we explored the possibilities of other sources. The most promising source seemed to be blood meal. This product has had very limited use for the purpose for which we required it but has been used primarily as a fertilizer, especially for sugarcane and similar crops needing the addition of considerable nitrogen to the soil for maintaining soil fertility. The blood meal as available in Indian markets is entirely unsuitable for feeding purposes, because it is usually prepared near the city boneyard and is undoubtedly adulterated with earth containing bacteria, many of which would be pathogenic for livestock. Since much of this commercial blood meal has remained moist for a long time and has undergone putrefaction, it is less palatable and of a lower nutritional value than it would be if it had been dried thoroughly while fresh. It was soon evident to us that in order to assure ourselves of a satisfactory product we must prepare it ourselves.

Method of preparation

After some experimentation we developed a simple, effective method of preparation. All the equipment needed can be secured or prepared easily in the bazaar of an average Indian city. We use a large iron kettle (*karahi*) over an open fire for heating the blood. A press similar to that used for making cider expresses the extra moisture from the cooked blood. This press can be made from the nut and screw as commonly employed in commercial *samai* machines. The only other items of equipment required are containers for the blood and a flat, dry, sunny surface. We bring the blood from the slaughter-house in a bull-drawn night-soil cart and the prepared product is dried on a cement roof.

In many of the slaughter-houses in Indian cities the blood is completely wasted; in others it is collected and prepared for fertilizer. We contract for all the fresh blood daily for a period of ten months of the year. Our men fill the cart with the fresh clotted blood accumulating in the gutter as the animals are being

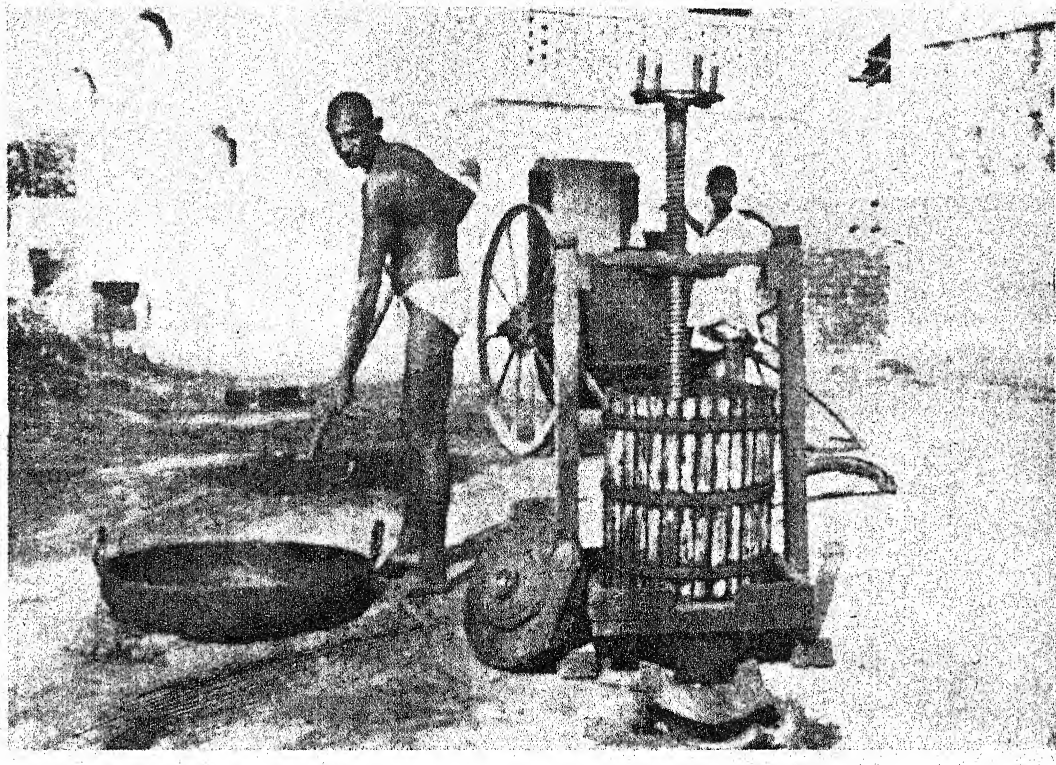

FIG. 1. Preparation of blood meal.

PLATE 27

slaughtered. Upon their return to our farm they heat to boiling about three gallons of water in the iron kettle and pour in ten gallons of the blood. It takes about a half-an-hour of heating with continuous stirring with a spade to cook the blood completely; the stirring is very necessary to prevent scorching and resultant lowered palatability. As soon as the blood becomes firm and similar in consistency and appearance to chunks of cooked liver it is removed to the press. Several pounds of water are squeezed out of it and thrown into the irrigation ditch. The resulting cake of blood is kept in covered tins overnight. (Animals are slaughtered late in the evenings, so that it is impossible to have the product ready for drying until late at night.) The longer the moist cakes stand the greater is the loss of protein. One can smell ammonia as it evaporates from the decomposing mass. Maggots also develop within a few hours. Thus it is essential that the cake be broken up into small particles and spread as thinly as possible over a hard surface exposed to the strong rays of the sun immediately. During the days when the sun's heat is intense the blood becomes dry and hard within one day. At other times two or three days of drying may be necessary; in this case it is a good practice to remove the blood in the late afternoon to prevent its becoming moist from dew. When the blood is completely dry it becomes black and brittle, in many ways resembling charcoal. It can then be broken up on a *sil* or crushed under a heavy iron or stone hammer. We prefer to grind our meal in a hammer mill. During moist weather, especially, a strong odour as of burnt feathers comes from the hammer mill; but if the product has been properly prepared it is quite odourless. The black blood meal will keep for months in a dry place; if it is allowed to become wet, maggots develop in it and the protein begins to disintegrate and give off ammonia.

The British method

During the present war the British have used a good deal of blood in feeding their poultry and it has been recommended in Britain that blood be cooked in a bag within a container of boiling water; this cooked blood is then fed moist to their poultry. We prefer to use our blood as meal in a dry state. This meal is mixed with grain and grain products to form a poultry mash or for feed for other livestock. The resulting feed may be moistened or fed dry; but in no case may more be moistened than will be consumed within a few minutes, since it deteriorates rapidly when moist. We moisten it only when we have whey or buttermilk to be fed to the poultry.

Suggestion for feeding

Blood meal contains the greatest amount of protein of any feed stuff. The figure usually given is approximately 82 per cent protein. Analysis of some of our meal shows approximately 90 per cent protein. Meat scrap contains about 55 per cent protein and few of the oil cakes contain more than 35 or 40 per cent protein. Thus it is evident that blood meal is a very concentrated feed. The following (Table 1) is a suggestion for feeding poultry when blood meal is to be the only source of animal protein in the diet:

TABLE I

Suggestion for feeding poultry when blood meal is the only source of animal protein

Mash feed		*Scratch feed*	
Maize (ground)	30 lb.	Whole barley	30 lb.
Wheat bran	20 ,,	*Jowar*	26 ,,
Ground barley	10 ,,	Whole wheat	26 ,,
Linseed oil cake	6 ,,		
Blood meal	12 ,,	Total	82 lb.
Mineral mixture	4 ,,		
Total	82 lb.		

These two feeds can be mixed together in equal quantities and fed in a trough or the mash may be fed in a hopper and the scratch feed scattered in litter or on clean ground. We prefer to feed both mixed together in a special trough. We find that this mixture maintains the growth and development of our poultry and keeps up the egg yield. For temporarily increasing the protein content of the feed we mix less of the scratch mixture with the mash mixture; this is done in the case of young chicks. The mash mixture contains 23·5 per cent protein and a mixture of the two feeds in equal amounts contains 17·7 per cent protein.

Very little scientific information is available on the value of blood meal as feed and it is a popular belief among feeders in America that it is of fairly low biological value as compared with the other sources of animal protein. Tests, however, have shown that the digestibility of blood is very high and there is little evidence to support this prejudice. We feel that if the blood which is now wasted throughout India could be made into blood meal of a quality suitable for feeding livestock, India's wealth would be increased and millions of her protein-starved animals could be more adequately fed.

SOIL CONSERVATION RESEARCH IN THE BOMBAY PROVINCE

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SOIL erosion is an age-old problem and a national calamity of great magnitude. The cumulative effects of this phenomenon culminate in famines and permanent damage to land, which have awakened in recent years the people all the world over. The urgent need to evolve sound conservation practices, suitable to different regions of the country to stop further wastage of soil and thus stabilize the national resources of the country is quite evident.

Research in soil conservation techniques

Research in soil conservation techniques has recently been undertaken in various parts of the world to evaluate and modify the conservation practices to suit the local conditions and to evolve new ones wherever required. In India, the Dry Farming Research Station, Sholapur, in the Bombay Presidency, leads the rest in soil conservation research. Experiments to study the extent of damage due to soil erosion under the climatic conditions of the 'problem area' of Bombay—Deccan were laid out in the medium deep soil at the Sholapur Research Station as early as 1934 on the same plan as was followed by Duley and Miller (1923) in their classic trials at Missouri (U.S.A.).

The climate and crop of the tract which mark it out as the 'problem area' of Bombay province is worth relating from the soil conservation point of view. The 'problem area' comprising the districts of Sholapur, Ahmednagar and Bijapur (Karnatak) and the eastern parts of the districts of Poona, Satara, Dharwar, etc. receives a low rainfall (about 25 in.) from both the south-west and north-east monsoons, the latter contributing substantially to the total. The erratic distribution of rainfall, heavy downpours of great intensity in a short period causing severe soil erosion and desiccating winds during long spells of drought are some of the unenviable characteristics of the tract. The predominant crop, covering more than four million acres of the 'problem area', is *rabi jowar* (*Andropogon sorghum*), which is known to possess drought-resistant characteristics. For the *kharif* season *bajri* (*Pennisetum typhoideum*) and *tur* (*Cajanus indicus*) along with minor pulses such as horse-gram (*Dolichos biflorus*), dew-gram (*Phaseolus aconitifolius*), black-gram (*Phaseolus radiatus*), etc. and groundnut (*Arachis hypogea*) are grown.

It must be noticed that the problem here in this tract is not only one of mere soil conservation (which is admittedly more vital) but is also one of moisture retention necessary for crop production under erratic rainfall distribution. Fortunately, what is done to conserve the soil also serves to conserve the moisture. Thus the two problems are closely related.

The results of the experiments conducted at the Research Station, Sholapur, to study the effects of different tillages on soil erosion revealed that natural vegetation, which is Nature's defence against soil erosion, allows little or no erosion of soil and any interference accelerates the rate of soil loss. The present practices open up the soil and leave it exposed to the ravages of soil erosion. The magnitude of such a loss can be realized by the fact that land sown to *jowar* loses on an average in one year 75 cartloads of soil (1 ton=2 cartloads), the maximum recorded being 266 cartloads per acre per year.

The economic implications of this colossal soil loss are tremendous. Taking the average rate of soil loss to be 75 cartloads per acre per year the whole seven inch surface layer of soil, which is the main feeding zone of the plants, will be lost in so short a period as one generation. When the loss is so great in the case of the medium type of soil, the enormity of the loss in the deep black soil, which is less permeable to water and consequently more susceptible to erosion, can well be imagined. Again an analysis of the eroded material (silt) disclosed that the loss of nitrogen, phosphoric acid (P_2O_5)

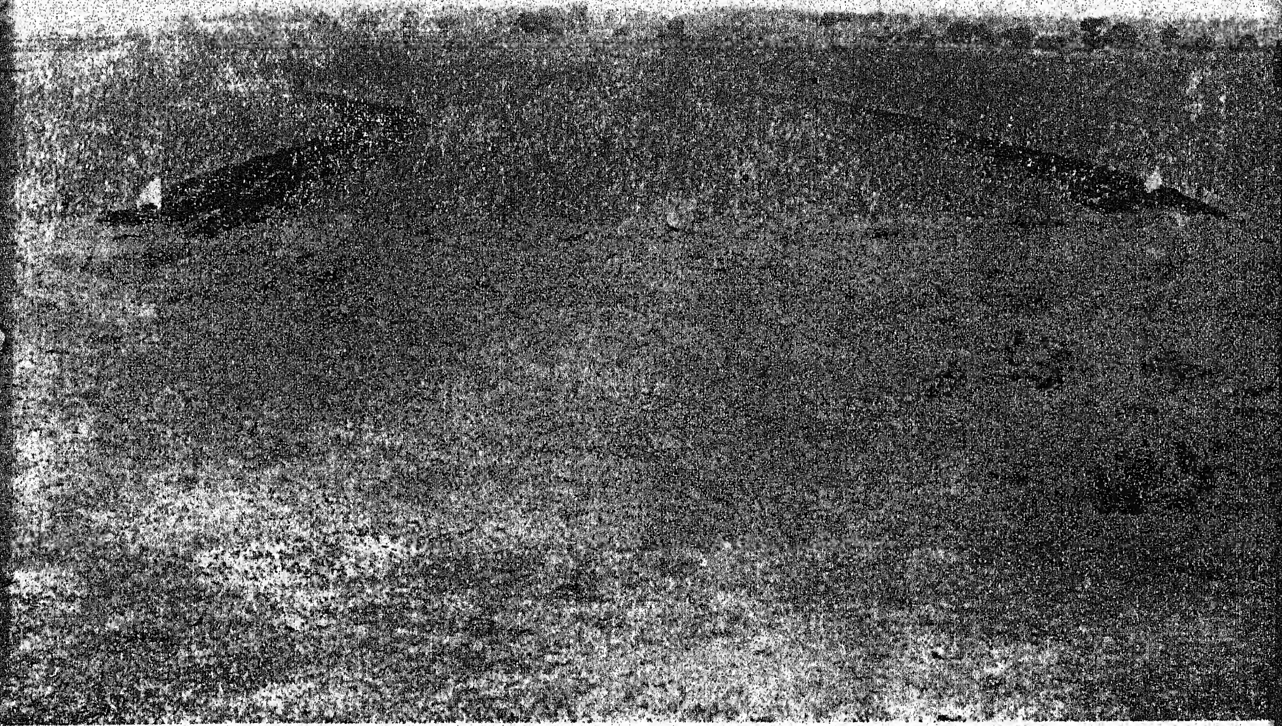


FIG. 1. *Kharif* contour strip cropping area. Nine rows of groundnut (A) is alternated with *bajri* (B). The mark (T) indicates the position of a portable silt collecting tank in the field.

PLATE 28]

FIG. 2. *Rabi* contour strip cropping area. Fifteen rows of groundnut (A) alternated with cultivated fallow (B) to be used for sowing *jowar* in the *rabi* season.

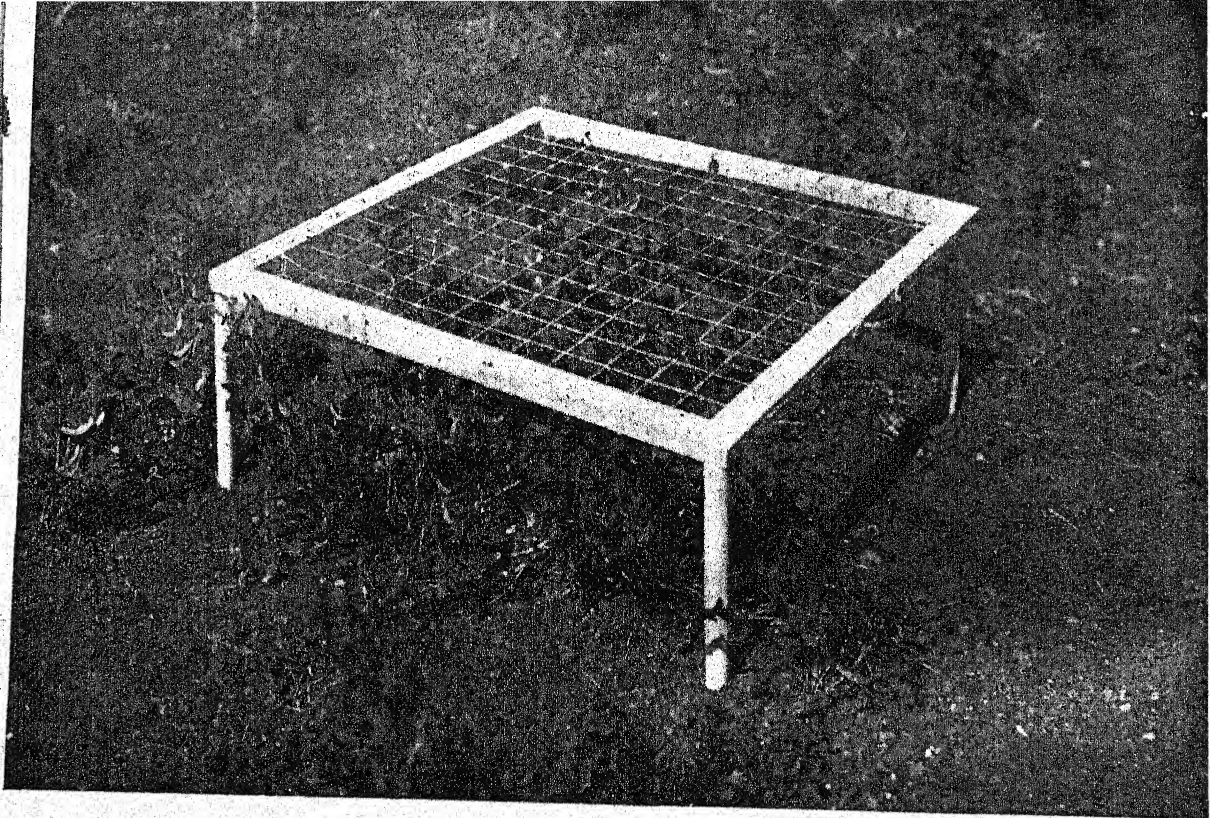
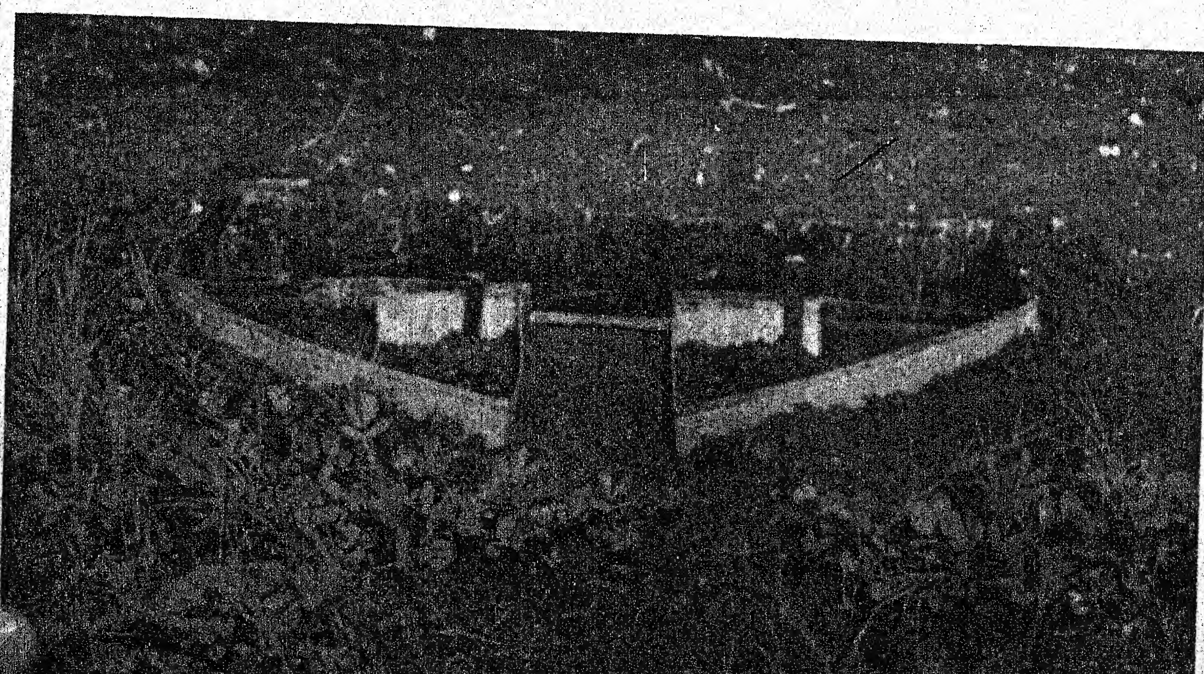


FIG. 3. A device to take precision readings of canopy development. The frame is 2 ft. square and the inside divisions are 2 in. square.

[PLATE :

FIG. 4. Portable tank used under field conditions to find the efficacy of different cultural and farming practices to check soil erosion. The tank has got a lid (L) to prevent the falling in of rain drops and other material from outside.



and potash (K_2O), the most important plant food nutrients vital for proper plant growth, is as high as 40 lb. of nitrogen, an equal quantity of phosphoric acid and ten times of potash per acre per year. This means that a farmer with an average holding of 30 acres of land will save in one year, if only he takes up to the soil conservation practices in his fields, nitrogen sufficient to produce 940 md. of *jowar*.

Although dry farming methods have been developed in various degrees in different parts of India, the soil conservation aspect of the problem has not received as much attention as it deserves. The results obtained from the experiments conducted at Sholapur indicated that natural vegetation preserved the soil efficiently. Hence it was tried whether it would be possible to simulate Nature by growing erosion-resisting crops to stop soil erosion. It has been observed that spreading crops like horse-gram, dew-gram, groundnut, etc. have a high resisting power to minimize soil loss. These crops can be grown in the *kharif* season of this tract and as such experiments were laid out to study the effects of growing strips of these crops alternated with strips of cereal crops permitting erosion. Strip cropping experiments were conducted for both the *kharif* season, when *bajri* (erosion-permitting) was alternated with erosion-resisting strips of groundnut, *hulga* and *matki* (Fig. 1) and the *rabi* season, when the groundnut strip was sown in the *kharif* season and the lands for *rabi jowar* (erosion-permitting) left fallow in the *kharif* to be sown later in September or October with *jowar* (Fig. 2). There is every possibility that this method of cropping may revolutionize the present farming practices in the Bombay province to fit in the future soil conservation programme as it is easy to follow and cheap to adopt and it is no wonder that this system has aptly been described by H.E. the Governor of Bombay Sir John Colville as 'bunding without tears' during his recent visit to this Station.

If effective results are to be achieved in checking soil erosion it is essential that the maximum canopy development of the crop synchronizes with the peak period of soil erosion. A suitable method has been developed to measure the periodic canopy development of different erosion-resistant crops at the Station (Fig. 3). It has also been found necessary to devise a portable tank to measure on a field scale, the efficiency of the systems of farming and cultural practices in checking soil erosion. Such a tank has been devised and worked out successfully at Sholapur (Fig. 4.)

Two schemes, one to conduct research on Contour Strip Cropping and the other to conduct research on the Land Improvement work in the bunded areas of the Province are in operation at present with headquarters at Sholapur. The problems that have been taken up by the Contour Strip Cropping Research Scheme are indicated below :

(a) To find out the most suitable economic cover crops including perennial grasses, shrubs, etc. in different tracts and under varying soil-climatic complexes in the province, particularly, in areas in which the Land Improvement Section is operating.

(b) To adjust seed rates of the erosion-resisting crops to afford optimum canopy of the crops to the land.

(c) To investigate the most suitable widths of erosion-resisting crops in combination with erosion-permitting ones for different soil types, gradients and climatic variations.

(d) To evolve a long-range cereal-legume rotation, i.e. a rotation of erosion-permitting crops with erosion-resisting ones, within the contour-stripped areas so as to maintain the maximum efficiency in soil conservation.

(e) To study the trend of fertility changes in the contour-strip-cropped areas.

Similarly the problems that are being tackled by the Land Improvement Research Section are briefly stated as under :

(a) To conduct scientific research and investigations on problems connected with the technical and economic aspects of soil and rainfall conservation, anti-erosion measures, etc. in different tracts and under varying soil-climate complexes in the province, particularly in areas in which the Land Improvement Department is operating.

(b) To investigate the relationships between soil properties and liability to erosion in different tracts and the effects of land improvement measures on the physical and chemical composition of soils over adequate periods of time.

(c) To maintain surveys of bunded and trenched areas with reference to the effects of anti-erosion measures on soil structure, etc., the factors causing breachings and other types of damage in relation to rainfall, gradient, soil type, etc. and the maintenance and durability of completed anti-erosion works.

(d) To investigate engineering aspects of anti-erosion measures, contour bunding, contour trenching, gully plugging, drainage of bunded areas, etc. with the object of increasing technical efficiency and reducing cost of construction and maintenance.

(e) To maintain adequate statistical data, rainfall records, etc. in connection with the work of the Land Improvement Department in the districts and to assist and advise the staff of the Department in the layout and management of large scale experimental work in connection with land improvement works.

Some of the specially qualified staff recruited for the above work will be soon sent abroad for further specialized training in the United States.

It will, however, be realized that soil conservation research in India is still in its infancy and Bombay has advanced well ahead of the other provinces in this direction. It is expected that great strides will further be made to introduce scientific systems of soil conservation on a nation-wide scale in the Bombay province as a result of the recent visit of Sir William Jenkins, the Director of Agriculture, Bombay, to the United States as he has recently arrived in India with vast experiences of the American conditions of research and organization.

SHORT TERM CROPS IN FAMINE AREAS

BOMBAY and Madras are mobilizing all internal resources to the maximum in their endeavour to ward off the disaster of famine. Cultivators have been subsidized to grow short term crops such as maize, *jowar*, *bajra*, *ragi*, etc. during the current hot weather. In Madras under its subsidy scheme of Rs. 15 per acre, half of which is met by the Central Government, 650,000 acres have been freshly brought under the plough at a cost of Rs. 97,00,000. The total estimated yield is about 100,000 tons, a major portion of which will come into the hands of the Provincial Government. Cultivators in the Bombay Presidency are offered a subsidy of Rs. 15 per acre for hot weather crops, but the extent of the area thus sown is not known and no financial assistance has been asked so far from the Central Government.—*B.P.I. Press Note*, May, 1946.

POULTRY INDUSTRY IN INDIA

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INDIA is one of the homes of the jungle fowl and is said to be the first country to rear domestic varieties of chicken. The number of poultry in the country runs into a ten digit figure and it is estimated that if eggs produced in a year were put end to end they would stretch four times round the world. In spite of these imposing figures, our poultry-industry has little national significance. There are hardly any commercial farms and poultry-keeping is not a factor of great importance in the economy of rural home. Statistics indicate that there are seven persons to one fowl in India. Poultry products have a comparably mean share in the nutrition of the people, the average annual *per capita* consumption being only eight eggs. Compare this to a young country like the United States of America, which has 3·1 fowls for every man, woman and child and an average *per capita* annual consumption of 267 eggs. In America more persons are interested in the actual production of poultry than in the raising of any other livestock and 85 per cent of all farms maintain poultry.

Grow more food

The present condition of the industry is most unsatisfactory, particularly when it is considered that there is a serious shortage of food leading to famine conditions in many parts. This shortage in total nutriments has been aggravated by a still greater scarcity of quality foods, like milk and eggs which are the best sources of essential proteins, vitamins and minerals. The growing of more and better food is therefore an urgent demand. The expansion of poultry industry can be one of the quickest means of increasing the resources of vital foods, as has been successfully demonstrated by the establishment of flourishing poultry farms under the management of military authorities in all parts of the country. Faced with the danger of shortage in vital food supplies, the army established its own poultry farms and in an amazingly short period began reaping a rich harvest.

Employment for many

Military poultry farms have also shown the way to the employment of a large number of young persons in creative and productive work. There is no reason why civilian administrations should not similarly provide employment to a large number of demobilized persons coming back to their fold from the army. A still greater and more fundamental need is to provide employment to the mass of Indian cultivators during the slack seasons in the fields. The average Indian holding of 2·2 acres does not provide work throughout the whole year for the farmer and his family and it is generally agreed that the economic and the social uplift of our peasants is dependent upon the provision of productive work to utilize this spare time. Poultry-raising is one of the subsidiary industries that can profitably utilize a portion of this leisure. It requires little capital or outlay and would bring more food to the peasant's household and increase the family income.

Soil reclamation

For centuries the soil in this country has been leeched of essential nitrogenous elements by successive intensive cropping, resulting in a marked deterioration in fertility. It is necessary to put back nitrogen into the soil as it is one of the chief sources of plant food. Farmyard manure is admittedly one of the best means to do so. One of the by-products of poultry-keeping is the manure produced. It is estimated that 1,000 hens produce 37·5 tons of manure per year. This manure is more concentrated than excreta from other livestock, because fowls eliminate the highly nitrogenous urine in the form of chalky material adhering to and mixed with droppings. Further, poultry manure is a valuable addition to compost. Its efficient utilization should, therefore, be the concern of all working for the reclamation of soil fertility.

Eat more eggs

There is certainly a case for the development of an industry which would provide employment to many and food for the people and manure for the soil of the country. This development depends entirely on an increase in the demand for poultry and eggs. The

diet of the majority of our population is greatly deficient in essential food factors. This deficiency, which has been greatly aggravated due to the abnormal conditions created by the war, is also well-marked in what are regarded as normal Indian diets. Recent work done in this country has shown that eggs are a very valuable supplement to correct the deficiency of such diets. To make the masses conscious of the value of eggs as a protective food, and in order to increase their production, a diet reform campaign is an urgent necessity. Though sentiment against the consumption of eggs in orthodox Hindu circles plays its part in determining their demand for eggs, it is by no means a major factor. This is evinced by the consumption of eggs in different parts of the country. Travancore, a predominantly Hindu area, consumes exactly four times as many eggs per head as Bengal, a predominantly Muslim area. Again such ridiculously low levels of consumption as 7·6 eggs and 10·0 eggs per head per year are recorded for the Punjab and the North-West Frontier Province, which are over-whelmingly non-vegetarian areas. Keep more poultry, eat more eggs and market only the surplus is the advice one should give to the masses of India.

Capital needed

Capital in India has been curiously shy of any venture in livestock production even on a modest scale. Poultry production was until recently a hazardous enterprise due to the widespread ravages of contagious diseases decimating poultry year after year. However, with the success in the elaboration of a vaccine against Ranikhet disease—the chief enemy of fowl population—a measure of control has been provided over poultry mortality and this will help to put the poultry industry on a sound business footing. There is a good market for eggs in urban areas which can not only be exploited but greatly expanded. Besides, export trade in eggs and egg products like albumin, dried eggs, etc. offers a lucrative market. Just before the war China accounted for nearly 95 per cent of the world export trade, one half of which was absorbed by the British Empire. There is every reason for India to demand a share in this trade and work for it. Enlightened capital is needed to start commercial poultry farms run on scientific lines to compete for world markets. It is, however, undesirable to divert the present production of the cottage poultry industry to foreign markets or to factories for the manufacture of egg products. The so-called surplus in eggs is not a real surplus. This is food which legitimately belongs to the family of the producer. It is necessary to start large-scale commercial poultry farms to feed such factories and to cater for world trade.

Personnel and organization

Lack of trained personnel is one of the most serious handicaps to the industry. There is no course of training in India comparable to that imparted in other countries, such as, course for the National Diploma in Poultry in Great Britain. A few government poultry farms provide elementary training, and the Imperial Veterinary Research Institute, Izatnagar, has recently started a four months' post-graduate course in poultry husbandry. It is needless to emphasize that it is an absolute necessity to have a course extending over at least two to three years for poultry training at one or more centres. Such courses could, with a little effort, be arranged at some of the existing veterinary and agricultural institutions in the country. A still more urgent need is to have an organization engaged exclusively in poultry development work. This organization may be similar to that which is being developed for dairying and fisheries in this country. It should be responsible for planning development, directing research, training personnel and providing help and guidance to poultry producers. The poultry industry of India is backward. The fowls are poor layers and little attention is devoted to their breeding, feeding and housing; poultry mortality is high (as much as 30 to 50 per cent of the fowl population every year), loss in egg collection and transport is high (amounting to 57 lacs of rupees annually) and the producer gets very little for his pains because of disorganized marketing. A great task awaits the organization that will tackle these problems and endeavour to raise poultry keeping to the status of a progressive national industry.

BUFFALO AS A DAIRY ANIMAL

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THE buffalo is a familiar animal of the tropics and her milk, which is particularly rich in fat, has long been used as a valuable human food in oriental countries. She has assumed a prominent place in India as a useful dairy animal and has become a serious rival to the cow. The buffaloes are abundant in the plains and moderately elevated places of the country and represent nearly 50 millions out of 215 million cattle in India. Out of the total annual production of about 750,000,000 maunds of milk, the buffaloes contribute 350,000,000 md.[1] There has been considerable controversy in the country regarding the comparative utility of the cow and the buffalo as a suitable dairy animal and several arguments have been put forward in favour of suppressing the latter in order to encourage the former, which has been regarded as the premier dairy animal from times immemorial. It will therefore be interesting to make a brief survey of the development of buffalo rearing in the country and a proper estimate of her position in the dairy economy of India.

Although the buffalo has been known in India for a very long time, it is difficult to trace the history of its domestication. No reference is available in our religious books on this subject as they all devote attention to the cow. In spite of the preponderant position of the cow in the Hindu religion, the buffalo has also been domesticated. In the *Arthasastra* written by the famous Kautilya, a mention is made of the buffalo and the higher butter content of her milk.

One major cause for the superior position of the cow is the fact that she gives bullocks for draught purposes in addition to her milk. In a predominantly agricultural country like India, this is no doubt a valuable argument, but it is unfortunate that due attention has not been paid by the public as well as the Government towards a systematic and scientific improvement of the buffalo, particularly for draught purposes. It will is widely believed that the buffalo is a sluggish ugly animal and the males are unfit for draught purposes. This appears to be an erroneous idea. The buffalo with its supposed ancestry from the bison, which is noted for its alacrity, ferocity and quickness in moving through the thickness of the jungle, ought to show more promising qualities if it is only trained for that purpose. With the development of irrigation in India, people have begun to prefer an animal like the buffalo which is more suitable to the swampy and slushy wet soils. In the case of carting and hauling farm produce, the buffalo makes up the deficiency in speed by his capacity to drag heavier loads. In sugar crushing and such other heavy work, the male buffalo has proved very superior and is widely used in the United Provinces, Bengal, the North-West Frontier Province and other provinces for all types of heavy work.

As regards the economics of maintaining the buffalo as a dairy animal, it will be seen that she does not require costly feeds like oil cakes, lucerne, etc. but appears to possess a remarkable ability to thrive on any kind of fodder and convert it into rich milk. On an average the milk yield of a buffalo is 1,270 lb. while that of a cow is 525 lb. per annum, i.e. the yield of the buffalo is nearly three times that of the cow. According to *Report of the Royal Commission on Agriculture* (1928), 'when prices of fodder is low the buffalo can compete with any breed in butter production and beat the ordinary cow in the production of both milk and butter. This is the main reason why villagers prefer the buffalo to the cow notwithstanding the fact that he has to pay a bigger price for the buffalo'. The economic producer of milk is undoubtedly a buffalo when we take into consideration the quantity of milk and particularly the fat produced by the buffalo. Wherever an important market for *ghee* exists, it is the she-buffalo which mainly supplies the requirements. According to Dr Wright (1938), of the total 690,000,000 md. of milk produced in India and Burma, 31·2 per cent is consumed as liquid milk and the rest as manufactured products, the main item being *ghee* (52·7 per cent). Not only on account of its nutritional importance in the dietary of the vegetarian population of the country but also as a means of conserving milk as a long-keeping food

[1] *Milk Marketing Report*, 1941

product, large quantities of milk are converted into *ghee*. *Ghee* is thus the main milk product produced in India and more than half of the milk produced is utilized for this purpose. This will substantiate the outstanding importance of buffalo milk whose fat content is nearly double as compared to that of a cow. Even in the case of liquid consumption, 12 per cent of the milk is consumed along with coffee and other beverages where the richer buffalo milk is always preferred. There is another argument advanced to show the superiority of the cow over the buffalo. It has long been believed that buffalo milk is not so suitable for human consumption, particularly infant feeding, as cow milk. The question is still debatable and latest researches have shown conflicting views on the point. For that matter, breast milk is the best for infant feeding and even cow's milk is required to be suitably humanized. The only point against buffalo milk for human consumption might be the high fat content and carotene deficiency. The former can be toned down if necessary and the latter can easily be supplemented by other foods. If this is still considered as a disadvantage, the other advantages of maintaining a buffalo as a dairy animal described above are far outweighing. It would therefore be in the interest of dairy industry of the country to give greater encouragement to the improvement of buffaloes.

The following are some of the well-known breeds of buffaloes found in the country and recently some of them are receiving considerable attention both in the hands of private breeders and in some of the Government farms:

Murrah or Delhi buffalo
Nili and Ravi buffaloes of the Punjab
Jaffrabadi buffaloes of Kathiawar
Surti or Nadiad buffaloes
Ellichpur or Nagpur buffaloes

Murrah buffalo

Murrah is the outstanding breed of buffaloes in this country and is a native of the southern Punjab. Murrah buffaloes are found in large numbers in Rohtak, Karnal and Delhi. These animals have a curly horn (*murrah* means curl of the horn) and are black or brown in colour. They are the best milkers and they have been introduced in many parts of India to improve the local stock. The average weight of a she-buffalo is 1,000 to 1,200 lb. and of a male 1,200 to 1,500 lb. The best type of this breed has given over 10,000 lb. and the average yield of a buffalo of this breed maintained at the Imperial Dairy Research Institute is 4,500 lb. per lactation of 300 days.

Nili breed of buffalo

This breed derives its name from the deep blue waters (*nili*) of the river Sutlej. The home of this breed is in the Montgomery, Multan and Ferozpur districts. The chief characteristics of this breed are close curled horns, black with white markings on the forehead, face, muscle and leg and the white switch. The average weight of a female buffalo is about 900 to 1,000 lb. and of a male 1,000 to 1,200 lb. The Punjab Government are maintaining a herd in Bahadurnagar Grantee Farm. The average yield is 3,500 lb. in 250 days.

Ravi breed of buffalo

This breed derives its name from the valley of the river Ravi. The home of this breed is Lyallpur district. The characteristics of this breed are a black and some times brown colour, wall eyes and white markings. Horns are broad, thick and curled away behind the base. The average buffalo yields about 4,000 lb. in 250 days.

Jaffrabadi breed of buffalo

These buffaloes are found in the Gir forests (Kathiawar). They are very large massive animals. They were formerly bred by princes and chieftains for fighting purposes. They have very prominent foreheads, heavy horns which are inclined to droop on each side of the neck and then turn up at the points. Good specimens give on an average 30 to 35 lb. of milk per diem.

Surti breed of buffalo

This is a breed of the Bombay Presidency. The best specimens are found in Nadiad, Anand and Bulsar taluks of the Kaira district. The Agricultural College Dairy, Poona, maintains a pure herd of this breed. Good specimens give on an average 20 to 25 lb. milk per diem.

Nagpuri buffaloes

This breed is largely bred in Central Provinces and in South India. The horns are very long, flat and carried back on each side of the neck, often behind the shoulders. They are largely used for draught work (slow). The females are considered good milkers. Good specimens give on an average 15 to 18 lb. of milk per diem.

Management of a buffalo herd

The buffalo is a very sensitive animal and requires to be handled carefully. From the experience gained at the Imperial Dairy Research Institute of managing large herds of buffaloes, some points are given below in connection with the proper maintenance and management of the milch herd of buffaloes so as to get the best results.

Buffalo usually matures in three or four years. If well-fed the animal matures early. If there is shyness in the heifer, it must be taken off by intensive handling.

Management of buffalo prior to calving

Buffaloes which have already calved and completed the lactation should be carefully dried off one or two months before calving by gradually reducing the milking to once a day and then prolonging the interval between each milking till the animal dries off completely.

During the dry period the buffalo should be well-fed and brought to a fit condition to stand the strain of calving and milking in the next lactation. The food given at this time should be nourishing and easily digestible and should provide nourishment to the foetus and should build up the flesh and strength of the buffalo herself. A detailed feeding chart for all classes of animals is given below.

The scale of ration for feeding the animals should be followed systematically if the herd is to be maintained in a satisfactory condition.

TABLE I

Scale of rations for buffalo herd

Class of animal	*Ragi* straw or dry fodder lb.	Green fodder lb.	Lucerne lb.	Ground nut or gingelly or linseed cake lb.	Gram or other husks lb.	Concentrate mixture lb.	Oats crushed or barley crushed lb.	Bran, wheat or rice lb.	*Gur* or *jaggery* lb.	Ginger powder dry oz.	Whole milk lb.	Separated milk lb.	Salt oz.	Minerals or feeding flour oz.
Calves upto 1 month											6–7			
„ „ 1-2 months		2–5	1				½	½			6	2	¼	¼
„ „ 2-3 „		5–10	½	½			½	½			5	4	¼	¼
„ „ 3-6 „		10	½	1			¾	¾			2	6	¼	¼
„ „ 6-9 „		20	½	¾			½	1					¼	¼
„ „ 9-12		20		¾			½	1					¼	¼
Young stock 1-2 years	2	28		¼	½		Gram crushed ¼	1					½	¼
„ „ 2-3 „	4	30		½	½		Gram crushed ½	1½					½	¼
Buffalo milking 20 lb. daily	3	70		¼	1	9							1	½
Buffalo dry	3	70				4							1	½
Buffalo down calves	3	70				3		3					1	½
Buffalo after calving (4 days only)	3	70						10	1	1			1	½
Buffalo bull	8	50				5							1	½

Composition of the concentrate mixture :

Bran	.. ..	4 parts
Cake	.. ..	2½ „
Husk	.. ..	2 „
Gram crushed	..	1½ „
Total	..	10

Calving

Three or four weeks before calving, the animal should be separated from the other animals and housed in a comfortable and well-ventilated place to accustom the animal to the surroundings of the calving place. At the time of calving, the buffalo should not be excited. The presence of strangers will cause unnecessary excitement to the animals. Just after calving, the animal should be given light food with lukewarm water as parturition weakens the digestive organs of the animal. The animal should be given concentrates in small quantities which should be gradually increased. The full ration should be given only after all the swellings and inflammations disappear. It usually takes about three or four weeks for the animal to become normal.

After the birth of a calf the navel chord should be cut and tied with a silk ligature using sterilized scissors and anti-septic solution. The best method to stop any infection gaining entrance through the navel is to seal with collodion or Stockholm tar and then paint iodine or rub copper sulphate or blue stone to shrivel up the chord. If this is neglected germs gain entrance through the chord and many diseases are caused resulting in high mortality in calves.

Management and rearing of a calf

Usually there are two methods of rearing a calf—the natural method and the artificial method.

The natural method: This is commonly practiced by all the farmers. It requires very little care and attention. The calf is reared on its own dam by suckling. Usually the buffalo after calving gets up and begins licking the calf. This stimulates the respiratory and circulatory system of the calf. The buffalo must be permitted to lick her calf dry; otherwise the new born calf's mouth should be wiped by running a finger round it to remove any mucus and then the calf must be rubbed briskly with cloth or gunny until dry.

The artificial or weaning method: This consists of separating the calf immediately after its birth from its mother without the buffalo's knowledge. In Indian cows and buffaloes, this must be done from the beginning. Once a buffalo knows the presence of her calf, on no account she will yield milk unless the calf sucks her. Weaning helps to produce clean milk and to maintain correct records of milk yield for adjusting the ration to be given. By this method, unprofitable animals can be weeded out at the end of a lactation. By weaning, the buffalo loses the motherly instinct and comes in season early resulting in regular calving, thus becoming more profitable for the cultivator and the calf suffers in no way as it will receive its full requirements of food artificially. Finally even if a calf dies, the buffalo goes on giving milk.

General management and treatment of matured herd

Good housing and feeding are the chief factors for ensuring success. The buffalo being a nervous animal responds to kind treatment. The animal must be given a good amount of water in which to lie down or bathed daily. Oil must be smeared to keep the skin soft. Good exercise must also be given.

The animal should be protected against the heat of the day and should be kept in a clean stall.

Feeding should be given at regular intervals using good food in generous quantities. Milking should be done at regular hours and intervals between milkings should be equal. Heavy milkers should be milked three times a day. During milking care should be taken to milk quickly and quietly without any noise.

Pedigree bulls should always be used to improve stock. Bulls should be used sparingly and services adjusted so that each bull is not used for more than one service a day and not more than 75 services in a year.

THE RELIABILITY OF RANIKHET VACCINE

IT is often asked—what proof is there, outside the laboratory, that the Ranikhet-disease vaccine evolved at Mukteswar is effective? The following note contains an answer.

Heavy mortality was experienced in one pen on the Military Poultry Farm adjacent to the Imperial Veterinary Research Institute Poultry Farm on 2 January, 1946, but, owing to deaths from other causes including fowl cholera, the presence of Ranikhet disease was not recognized until 8 January, 1946. Necessary instructions regarding isolation of the affected pen were issued as soon as the losses occurred, but eventually the disease spread to the greater part of the farm and over 3,000 birds were lost during the month of January. None of the birds had been previously inoculated against Ranikhet disease with chick embryo vaccine. Vaccination on the military farm was begun on 24 January, 1946 and completed on 26 January, 1946. Losses from Ranikhet disease were last recorded five days after the completion of vaccination.

Cases of Ranikhet disease were diagnosed in one pen on the Imperial Veterinary Research Institute Poultry Farm on 3 January, 1946, and eventually three pens containing a total of 48 birds were involved. In these pens 22 birds had previously been inoculated against Ranikhet disease, some in 1944 and the others in 1945. Seventeen birds out of the 26 non-vaccinated ones died from Ranikhet disease, while no deaths occurred amongst the vaccinated ones. All the birds in the three affected pens were quarantined in their houses as soon as disease was suspected, and the non-vaccinated birds in these as well as in the adjacent pens were vaccinated against Ranikhet disease within 48 hours. A fresh outbreak of the disease was diagnosed on the 5th February, 1946, in one pen of non-vaccinated chickens in a brooder house; vaccination of these birds had not been done as they were considered to be too young for routine vaccination. All the birds in the affected pen were destroyed to prevent any possible spread of the disease to the other pens and the rest of the birds were vaccinated without delay. No losses from the disease were experienced in any of the other pens.

The high losses experienced on the Military Poultry Farm can be attributed to failure to carry out routine vaccinations with the vaccine which has been recently evolved at the Institute, delay in carrying out vaccination once the disease was diagnosed, and breakdown in quarantining the affected pens from the healthy ones. The comparative low losses in the pens on the Institute's farm can be attributed to previous vaccinations against Ranikhet disease, over 90 per cent of the total stock in the runs had previously been vaccinated, prompt quarantining of affected pens and vaccination of the non-vaccinated birds in the affected and adjoining pens. In fact, a striking feature of the outbreak was the absence of Ranikhet disease among birds which had been vaccinated in 1944 or 1945.—*Imperial Council of Agricultural Research*.

THE 1946 BATCH OF NEW Co. CANES

THE 1946 batch of Co. canes consists of eleven canes, Co.634 to Co.644 (both inclusive). Two of these canes, viz. Co.635 and Co.636 are of Co.301 parentage and in selecting them the characters of non-flowering and relatively less pith formation have been kept in view. Co.638 is an early ripening cane. Co.644 possesses the rather rare combination of good yield and satisfactory sucrose and is a promising variety. Co.641 is a Co.419 type of cane, not likely to lodge in areas subject to cyclones. The parentages and general characteristics of these canes are given below:

Serial No.	Co. No.	Parentage	General characteristics
1.	Co.634	P.O.J.2878 × Co.313	Co.312 class of cane but with better habit. Somewhat soft-rinded.
2.	Co.635	Co.270 × Co.301	A vigorous non-flowering mid-season cane.
3.	Co.636	P.O.J.2878 × Co.301	A Co.421 class of cane but with much less pith.
4.	Co.637	Co.213 × Co.313	A mid-season cane of fairly good habit.
5.	Co.638	Co.421 × Co.313	An early ripening variety.
6.	Co.639	(P.O.J.2725 × *Sorghum Durra*) × Co.453	A Co.313 class of cane but with better yield.
7.	Co.640	P.O.J.2878 × (Vellai × *Sorghum Durra*)	A mid-season cane of satisfactory juice quality.
8.	Co.641	Co.443 × Co.281	A Co.419 type of cane sparse in flowering and not likely to lodge.
9.	Co.642	P.O.J.2878 × B.3412	A Co.421 type of cane but definitely thicker.
10.	Co.643	Co.443 × Co.605	Co.290 type of cane but somewhat thicker.
11.	Co.644	Co.603 × S.G. 63/32	Co.313 type of cane but a heavy yielder.

—I.A.R.I.

E 600

E 600 is a German insecticide developed during the war; some claim it is better than DDT.—*Science News Letter*, April 20, 1946.

What would you like to know?

Enquiries regarding agriculture and animal husbandry should be addressed to the Directors of Agriculture and Veterinary Services in provinces and states. This section is reserved for replies to selected letters in cases where it seems that the information may be of general interest.

Q. Would you kindly favour me with your comments on 'packing in ice' as a method of preserving fresh fish and prawns for commercial purposes? (N.R.N.)

A. Preserving in ice or 'packing in ice', as it is called, is not the best method of preserving fresh fish and prawns for commercial purposes for the following reasons:

(1) Preservation is inadequate and lasts for a very short time. The temperature of ice is not sufficiently low and the cold takes too long to penetrate even small fish. In the meantime the fish deteriorates and taint sets in. At the most the fish so packed in ice is in reasonably fresh condition only for a few hours.

(2) Undesirable changes occur in the fish making it insipid. It is well-known that icing cools the fish only gradually and consequently helps to form large crystals which tear and damage the tissues. The juices of the fish run out when thawed and render it tasteless.

The only effective method of preservation known is freezing of fish in much lower temperatures. More than two dozen patent methods of freezing fish exist. For these methods refrigerating plant or machinery is needed. If one cannot afford the capital expenditure for a fish-freezing plant, freezing of small fish or filleted (sliced and boned) large fish is practicable with freezing mixtures such as crushed ice and salt as in the manufacture of ice-cream. This method, however, is not advocated for general commercial practice as this process is more expensive and less efficient than freezing fish in a proper refrigerating plant. (B.S.R.)

Q. May I know what are the prospects of fish manure industry in the post-war period?

A. Besides its use in tea and coffee estates as a valuable nitrogenous fertilizer, fish manure was largely in demand for export. During the quinquennium ending 1939-40 India exported on an average 109,128 cwt. of fish manure valued at Rs. 4,59,048 per annum. The quality of the manure produced is often very poor. 'Beach dried' manure is very largely contaminated with sand. Our chief buyer is Ceylon where specifications have been prescribed for fish manure. Our samples hardly ever come up to the Ceylon specifications and full prices are not obtained by our exporters. To develop the manure industry in the post-war period, the method of production should be improved; drying of raw fish without previous boiling should be discouraged and only '*guano*' should be produced. (C.A.M.D.)

UNITED PROVINCES

M. R. MAHAJAN

Cattle Development Officer, Department of Animal Husbandry, United Provinces

THE war and post-war needs of the province necessitated the development of meat animals, sheep, goat and pigs, etc. and steps were taken accordingly soon after the amalgamation of the Veterinary and Livestock Departments early in 1944. The requirements of the army, stationed within the province, and the demand of meat dehydration factories at Patna, Agra and Delhi for these animals were ascertained and after assessing the resources of the province, the quota for consumption was fixed keeping in view the conservation of breeding stocks. The rigid control exercised in this respect through the United Provinces Slaughter Control Order and the steps taken for a rapid and better development by breeding programmes executed through the Departmental machinery, amply repaid the efforts as is evident from the following census figures :

	1945	1944	Variations 1944 to 1945
Sheep	18,15,337	18,73,873	— 58,536
Goats	59,08,367	54,72,942	+ 435,425
Pigs	13,17,696	12,26,853	+ 90,843

To improve these animals, stud rams, bucks and boars of improved varieties were issued to breeders. Arrangements to produce and issue stud males were made from the Barbari Goat Breeding Scheme at Etah jointly financed by this Department and Imperial Council of Agricultural Research, from the Departmental Jamnapari Village Goat Scheme in Chakarnagar (Etawah), and the Sheep Farm at Orai and the Agricultural Institute, Naini, (Allahabad) which was subsidized by the Department to produce stud boars. The stud animals issued were as follows :

	No. of bucks issued	No. of rams issued	No. of boars issued
1940–41 ..	58	..	..
1941–42 ..	88	..	..
1944–45 ..	28	21	17
1945–46 ..	40	38	70

These were issued to bonafide breeders on contribution basis at the following rates :

Barbari bucks	Rs. 2
Rams	Rs. 5
Jamnapari bucks	Rs. 5
Boars	Rs. 10

Sheep breeding

At the Sheep Farm, Orai, Bikaneri rams are used to improve the Jalauni and Fatehpuri ewes. The yield of wool was 1 lb. 9 oz. per ewe per year. At the Phulahi Sheep Centre, in Allahabad district, the Department continued to maintain improved Bikaneri rams and allowed them to run with the local flocks during the breeding season, i.e. April to July. A shearing and grading centre for wool also functioned at Phulahi with a view to obtain better prices. Mirzapur, a big carpet producing centre in India, consumes wool in large quantities and the sale of improved wool at that place fetched a price of Rs. 98 per maund. The Department is preparing schemes for extension of wool grading centres. Steps were taken to improve sheep breeding in the hills and a farm at Gwaldom in Upper Garhwal for local sheep has recently started functioning. Another farm is likely to be started at Pipalkoti (Garhwal) with imported Kangra valley sheep which are famous for hill transport work. The sheep farms in the hills have the following objects in view :

(a) to evolve, by judicious selective breeding and general management, sheep, which can thrive well on roughage under ranching conditions and produce more wool of a better quality,

(b) to serve as demonstration farms and training centres for the public, particularly ex-soldiers, in improved methods of sheep husbandry, and

(c) to produce high class rams to be issued for stud purposes in sheep breeding tracts of the hills.

Goat breeding

The Department continued to run the Jamnapari Village Goat Scheme, started in

1938, at Chakarnagar (Etawah district). One hundred and sixty-four animals comprising of 27 bucks and 137 nannies remained on Government subsidy. The subsidy amounts to Rs. 2 per month for a female and Rs. 3 for a male and is granted on the condition that the owner should maintain at least five approved animals. The scheme is yielding excellent results. The breeding area is the trans-Jamuna-Chambal valleys and their proud owners are the militant Rajputs and Ahirs spread over in 37 villages. This area is known as *oont patti* (the land of the camel) and has excellent fodder trees and shrubs. The improvement effected by the Department was much in evidence at the annual show in March, 1946. There were 678 entries of good type in the show. The height of the male has increased from 40 in. to 45 in. and at the milk competition, the yield of a number of goats exceeded 2½ sr. at a time, the maximum being 3 sr.-3 ch. The prices of such high yielding goats vary from Rs. 100 to 200. A sum of Rs. 804 including Rs. 104 from the All-India Cattle Show Committee was distributed in prizes. The Barbari Goat Breeding Scheme at Etah produced 36 male kids for use as stud rams. The highest lactation during the year was 346 lb. Steps have been taken to continue the work by the Provincial Government when this scheme terminates in June, 1946.

Pig breeding

A non-recurring grant of Rs. 17,500 was made to the Agricultural Institute, Naini (Allahabad) to establish a piggery and a subsidy of Rs. 300 per mensem was granted to maintain stud boars, on the condition that all the boars produced for stud will be made over to the Department for issue to the breeders on contribution basis within the province. Keen interest to take up improved pig breeding as a profitable industry was evinced by the breeders and the Departmental staff assisted them in their efforts by the provision of stud males. Besides meeting the needs of the province for pig meat, export was allowed to the Punjab and Bengal to meet the requirements of the army. As the interest and demand created are continuing, the Department has taken over the army's surplus piggery at Babugarh and will run it to provide stud boars.

Sheep and goat markets

The important sheep and goat markets for the province are Deochara (Bareilly), Khair (Aligarh), Idgah (Agra), Madnapur (Mainpuri), Bajhera (Shahjahanpur), Fetehpur, Gubnahura (Basti) and Simraianua (Basti). All these are being attended to by the staff and their sale is regulated.

INLAND FISHERIES, VOCATIONAL TRAINING COURSE[1]

THE development of fisheries has been recognized as one of the main items of post-war reconstruction programmes in India.

The Royal Commission on Agriculture strongly advocated that all measures practicable towards developing the inland fishery resources of this country, should be taken.

It is therefore imperative that everything possible should be done to invite the attention of the men in the Defence Services to the splendid opening that lies before them in this line and to educate and train such of them as are willing to take rural pisciculture seriously.

Object

The object is to train as many I.O.Rs. as possible in rural pisciculture, to demonstrate to them the handsome profits that accrue from this industry and to encourage them to take to rural pisciculture as a means of livelihood or at least as a means of earning a supplementary income.

Method

At the instance of the Army, the Department of Fisheries, Bengal undertook this training. (The Army Department that deals with the question of resettlement of service men took the initiative and asked the Bengal Government to help).

The Director of Fisheries planned the course which consists of series of lectures in the vernacular (Bengali in the first instance). The trainees have been given ample opportunities to see the fishing and piscicultural operations carried on at the Government Fish Farms, and at other places in the suburbs of Calcutta and Sunderbans.

Details: Every month 20 selected I.O.Rs. are sent to undergo the course. Along with

[1] For the first batch of military and fishery overseer trainees (22 October to 15 November 1945), sponsored by the Directorate of Fisheries, Bengal

them 10 Fishery Overseers of the Department posted at different districts are sent to undergo training. The period of training lasts for three weeks and is divided into two parts—two weeks for theoretical and one week for practical training. At the end of each course a proficiency test examination is held and the successful candidates are awarded certificates of merit.

Lectures

Theoretical: A short course of lectures is given in the theoretical class under the following heads:

(1) General; ecology and biology of fish ponds.

(2) Hatchery pits, nurseries, rearing and stocking ponds.

(3) Various types of ponds, and how to correct non-productive ponds.

(4) Preparation and care of fishery ponds.

(5) Manuring of ponds and its significance.

(6) Distinguishing features, feeding habits and zonation of *katla*, *rohi*, *mrigal* and *kalbasu*; advantage of mixed farming.

(7) Factors influencing growth of fishes, artificial feeding.

(8) Breeding habits of the principal carps.

(9) Collection and transport of larvae and fry.

(10) Economics of carp culture.

(11) Fish parasites and diseases, and how to control them.

(12) The fish farmer and his implements.

(13) Fish marketing on a cooperative basis and collective farming.

(14) Public health fish farming.

(15) Agriculture and fish culture as correlative industries.

Dr S. L. Hora, Director of Fisheries and Officer-in-charge, Training Course, delivered a lecture on economics of carp culture, Mr K. N. Das, Superintendent of Fisheries, opened the class with a lecture on general fishery matters and Mr S. P. Basu, Superintendent of Fisheries and Lecturer-in-charge, Training Course, delivered the remainder of the lectures.

Practical

The practical course is for one week and consists of: (1) identification of fishes (carps), (2) identification of predacious fishes, (3) identification of larvivorous fishes, (4) demonstration in cleaning the bottom of and clearing weeds from, fish ponds, (5) eradicating predacious fishes and (6) demonstration in the manuring of ponds and in the artificial feeding of fish. The majority of the practical classes were held in the Government Fish Farm but the trainees were also taken to study conditions on the spot to the following places: (1) the nursery tanks round about Calcutta, (2) sewage irrigation fishery and (3) spawn and fry markets.

Thanks are due to the following gentlemen: (1) Mr A. H. Bhuiya, Proprietor, Bagmari Ideal Fishery, Bagmari, Calcutta, for allowing the teachers to study the conditions of his nursery rearing and stocking ponds and for demonstrating to the students the method of cleaning the bottom of and cleaning the weeds from his fishery area; (2) Babu Nripendra Purkayast, Officer-in-charge, Bidyadhary Spill Area Matsyajibi Samabay Samity, 24-Parganas, for showing them the sewage irrigation fishery, the method of catching fish in fresh water *bheri*, the method of transport of fry and different fishing implements; (3) Mr Haniff, Proprietor of Hazinagar Fish Farm, Sundarbans, to study the paddy-cum-fish culture and salt water fishery; (4) Messrs. Globe Nursery, Dum-Dum, 24-Parganas, in allowing them to study their nursing, rearing and stocking tanks.

All the practical classes were conducted by Mr S. P. Basu, Superintendent of Fisheries and Lecturer-in-charge in the Field who also gave instructions at the above-mentioned fisheries on the correct methods of pisciculture. Besides these the practical problems were discussed with the trainees in the field to give them a first-hand information about pisciculture.

Examination

The proficiency test examination was held at the end of the course, on 15 November 1945 at 1, Deodar Street, Ballygunge. The test examination consisted of three papers. Two theoretical papers of 200 marks and one practical and oral paper of 100 marks. The trainees were examined in the theoretical paper on the following subjects:

(1) Utility of pond culture. (2) Cultural operations—(a) characteristics of tanks required for hatchery, nursery, rearing and stocking, (b) defective tanks and how to correct them, (c) different kinds of manures used in fishery tanks and how to apply them, (d) methods of improving annual and perennial tanks and how to utilize them for improving fish farms. (3) General characteristics of identification of major carps of Bengal. (4) Ecology and biology of fishery ponds and the factors influencing the growth of fishes. (5) Breeding habits of principal carps of Bengal and transport of their larvae

and fry. (6) Economics of carp culture, collective farming and the implements required for fish farming. (7) Relation between pond culture and pisciculture, as correlative industries.

The practical examination consisted of identification of the following fishes: carps, predacious, larvivorous fishes. The oral consisted of utilization of the fishes for fish farming, method of eradication of predacious fishes, etc.

Dr Nazir Ahmed, Superintendent of Fisheries, examined the trainees as an external examiner, for which thanks are due to him. Fourteen military and 9 fishery overseers, 23 in all, appeared in the examination and all of them were successful. The result given in order of merit is as follows :

Fishery Overseer

Positions are given in order of merit

Distinction (65 *per cent and above*)

(1) B. Majumdar (Fishery Overseer, Birbhum)
(2) Shib Nath Mukherjee (Fishery Overseer, Santiniketan) } Second
(3) Akram Ali (Fishery Overseer, Tippera) } Second
(4) G. B. Gorey (Fishery Overseer, 24-Parganas)

Credit (50 *per cent to* 64 *per cent*)

(1) Shamsul Huque (Fishery Overseer, Dacca)
(2) Md. Zaynal Abedin („ „ Chittagong)
(3) Pravakar Das („ „ Midnapore)
(4) K. A. Kuddus („ „ Bankura)
(5) Md. Kabir Hussain („ „ Bakhergunge)

Military trainees

Position given in order of merit

Distinction (65 *per cent and above*)

(1) Hav. A. Latiff No. 770785 (R.I.A.S.C.)
(2) Hav. Clk. K. R. Bose No. 1733 (I.E.M.E.) } Bracketted second, fit to be instructor
(3) NK. T. Hussain No. 195328 (R.I.A.S.C.) } Bracketted second, fit to be instructor

Credit (50 *per cent to* 64 *per cent*)

(1) NK. K. Uddin No. 24174 (I.P.C.) } Bracketted
(2) Hav. A. Rashid No. 26807 (I.P.C.) } Bracketted
(3) NK. J. Abedin No. 191601 (I.P.C.) } Bracketted

Pass (40 *per cent*)

(1) L/NK. A. Zalil No. 32314 (I.P.C.)
(2) L/NK. N. Islam No. 502499 (I.P.C.)
(3) Sep. S. Ahmed No. 581051 (I.P.C.)
(4) L/NK. S. Ahmed No. 19864 (I.P.C.)
(5) Sep. S. Ulla No. 631932 (I.P.C.)
(6) Sep. H. Mia No. 181521 (I.A.O.C.)
(7) L/NK. Z. Ahmed No. 625614 (I.P.C.)
(8) L/NK. A. Rahman No. 522788 (I.P.C.)

Conclusion

In conclusion it may be pointed out here that, although the course was very short, attempts were made as far as practicable to give them a sound basic knowledge of pisciculture and practical demonstrations in pisciculture. Dr S. L. Hora, Director of Fisheries, and Officer-in-charge, Training Course and Col. Bapty, S. R. L. O. Bengal and Assam, took much interest in the course and gave ample facilities for making the training a success. The military authorities were kind enough to depute one three-ton truck, or railway warrants whenever necessary, to take the military trainees to the different fisheries in Calcutta and suburbs. On account of these facilities, the trainees were able to see many fisheries within this short period, which otherwise would have been impossible. Thanks are also due to the Government of India and the Government of Bengal, for allowing Mr S. P. Basu, Superintendent of Fisheries and Lecturer-in-Charge, Training Course, to deliver the lectures and to take practical classes during the whole period of training.

NOTE ON COOPERATIVE FARMING

Rai Bahadur R. K. Prasad
Registrar Cooperative Societies, Bihar

THE experiment of cooperative farming was taken up only very recently in two areas in Muzaffarpur district. The first experiments are being made at places where Cane-growers' Cooperative Societies are fairly well-established, viz. Bithauli and Silout. Generally the old members of the society or societies volunteer to have the experiment made with their plots and where there are intervening plots belonging to non-members, these are also included in the scheme, but with their specific consent. Under the existing

byelaws all agriculturists can come in as members of the society.

Cooperative society

These societies have formed a sub-committee to carry on this experiment of cooperative farming under the guidance of departmental officers. At Bithauli 45·76 acres of land in one bloc and at Silout 44 acres in two blocs have been voluntarily placed at the disposal of societies for cultivation purposes. The growers, both members and non-members, have signed a contract to this effect and they have retained their right to ownership over those plots as before. They have further agreed not to make any change in their right over those plots without the consent of the society. The society, through the sub-committee, will carry on cultivation in the best possible manner with the full cooperation and assistance of the growers concerned. The help rendered by the growers will be duly accounted for and suitable return will be given to them out of the produce which will be debited towards the cost of cultivation. The members have agreed to contribute on this basis. The marketing of produce will be done just like sugarcane if desired by the members concerned and cash will be paid to them.

The funds

The funds of the societies have been placed at the disposal of the sub-committee to finance this experiment and they have been also advised to borrow both short-term and long-term loans either from their own Central Marketing Union or the Provincial Cooperative Bank or the Government. The Joint Registrar has been pleased to sanction them Rs. 200 each out of Rs. 1,000 placed at his disposal for meeting the initial expenditure and the Government have been further approached by the Joint Registrar to place 1·62 lacs of rupees, which represents the saving in the compensation fund, at his disposal for the purpose. The societies are not in a position to incur heavy capital expenditure at present and that is why the Government is being approached for necessary financial help. The immediate needs in these societies are for wells for irrigation and constant and regular supervision by the officers of Agriculture Department.

Supervision

The sub-committee and the managing committees of the societies will actually supervise the operation of this scheme in close contact with the Government staff of the Cane-growers' Cooperative Societies in charge of the area. One supervisor of Cane-growers' Cooperative Societies has been deputed at each of the two societies specially for this work.

The two societies are reported to be carrying on marketing of sugarcane for some years in the past on cooperative line most successfully.

The land has been surrendered to societies by growers for cultivation which is being done on behalf of the societies on cooperative basis. To demarcate the individual possession of each member-grower, the entire bloc has recently been surveyed by an *amin* and a map of each individual holding together with the necessary details has also been prepared for guidance in future.

Labour

Labour is paid for at the market rate in cash if so desired or the same is credited to the account of the person concerned. The surplus resources of the growers both in man power and cattle, or implements or even farmyard manure, etc. are given preference to the ordinary hired labour of outside growers who are only required to make up shortage, if any.

After meeting the cost of cultivation and paying the charges of rent or revenue over the land, a provision has been made for depreciation and the repayment of loan by instalments which might be 10 to 20 per cent of the saving. The rest of the produce will be shared by the grower members on the basis of their land areas proportionately in kind or if it is to be sold and the cash value to be appropriated by the members, the sale will be effected cooperatively.

Besides these two societies of Muzaffarpur, three Cane-growers' Cooperative Societies of Champaran, viz. Churiharwa, Pandey-tola and Jhakra, have also started this experiment of cooperative farming in 98 acres, 9 acres and 10 acres of land respectively.

Consolidation of holdings

About measures to be adopted to accelerate consolidation of holdings and to prevent fragmentation in future, the author may mention that an attempt was made in the past to carry out experiment regarding the consolidation of holdings on a cooperative basis in two of the Government Estates, viz. Khurda and Bettiah. The experiments were failures and the concensus of opinion was that consolidation of holdings was not possible under the existing Tenancy

Laws and the conservatism of the agriculturists. The biggest obstacle is anticipated from the landlords. It may be argued that even if some of the landlords agree, there is no justification for the Government to spend money on staff as there is no return. From the Punjab, it is reported that consolidation of holdings has materially improved the areas and consequently the produce. The Government took advantage of this at the next settlement; the increased revenue made up for the money that was spent. But in a permanently settled area like Bihar, the Government cannot get anything out of the increased revenue. The author is of opinion that once multi-purpose whole village societies are organized and are run in a healthy condition we might try consolidation as an experiment in suitable areas.

BALUCHISTAN

MOHD. ISHAQ

Biochemist, Department of Agriculture, Baluchistan

UNDER the peculiar climatic conditions of Baluchistan, there are several very serious pests of fruit trees, vegetables and crops. In order to deal with them effectively, the small Entomological Section has been considerably enlarged since May, 1945. One of the major problems is the control of codling moth which destroys about 80 per cent apples, pears and quinces, particularly in the old orchards. The work, consisting of the control of the pest in the province itself and checking its spread from Afghanistan into Baluchistan and from Baluchistan to other parts of India, has been taken in hand and thousands of trees have been cleaned, during winter, of the hibernating larvae of codling moth. In spring, regular lead arsenate sprays will be given to kill the progeny of moths developing from the larvae which might have escaped destruction. Arrangements for the fumigation of fruits are in hand in order to check its spread. Grass hoppers threatening the germination of wheat crop in the Loralai district were successfully controlled by poison baiting. A preliminary survey of the major crop and fruit diseases was conducted by the Mycologist and efforts were made to popularize the seed treatment method against the bunt of wheat in Quetta valley.

Need for mechanical cultivation

Of late, a great need for mechanical cultivation has been felt in Baluchistan. There are vast tracts of land which despite their fertility remain uncultivated for want of labour and draft animals. Under the 'grow more food' drive, the Government intended to introduce mechanical cultivation and as a result of this several tractors have recently been imported and arrangements for other necessary equipment are in hand. Efforts are being made to increase the production of fresh vegetables in order to meet the growing demand of military garrisons in Baluchistan and Sind and of the civil population of Quetta and Karachi. Necessary facilities, e.g. monetary help, artificial fertilizers and farmyard manure are being provided to the vegetable growers by the Government. To give impetus to the 'grow more food' campaign, the Government of India have recently sanctioned a scheme for converting the vegetable and town-refuse into compost. It is proposed to start 25 centres in the province aiming at a production of about 6,000 md. of ready compost from each centre within a period of about six months. Prizes of Rs. 500 per centre have also been provided to induce the zamindars to dig pits for compost-making.

Canning of fruits and vegetable

A public limited company for canning and preserving fruits and vegetables has been floated with a subscribed capital of over Rs. 5,00,000. A suitable site for the factory has been selected, arrangements for machinery are in hand and it is hoped that the factory will start working in the coming fruit season.

MINERAL POISONS AFFECTING STOCK

D. H. Le Souef

THE following is as general a treatment as possible of the manner in which stock may gain access to poisons, the symptoms which follow, and the common antidotes and general preventive measures necessary to avoid a recurrence.

Lead

The poisonous forms of lead are litharge, red lead (used in paint and for plumbing), white lead (the common pigment, also used in the manufacture of linoleum and oil-cloth), lead arsenate (for spraying fruit trees), and the common metallic lead.

Most common source of lead poison is paint. Victims are usually cattle which have an apparent liking for the sweet taste and several cases of poisoning in this way have been reported.

Another known case is where two cows died suddenly with acute symptoms arising from arsenate of lead spray.

The acute symptoms are colic, convulsions, coma, blindness, coldness of extremities, and passing of hard black faeces. Symptoms may appear after the first day and up to a week from the time of taking the poison.

Horses are less susceptible than cattle, pigs, or sheep. Birds, however, are most susceptible to this poison and care must be taken when painting a fowl run or, more particularly, a cage for members of the parrot family which cling to the wire. Treatment, which is likely to be successful if started in good time, consists of a drench of Epsom salts (6 oz. to cattle) followed by raw milk and tea or coffee, brewed strong and allowed to cool.

Arsenic

Arsenic occurs in a poisonous or toxic form in weed-killers, wheat-dressings, and sheep-dip. As an oxide (white arsenic) it is almost insoluble and not dangerous, but the alkaline salts of sodium and potassium are readily soluble. These salts which are mixed with sulphur, soap, and so on to form sheep dip contain about 20 per cent of soluble arsenic, and 3 per cent insoluble arsenious sulphide for protection between dippings.

Most danger comes from dips. Dipping rams while hot after droving and allowing stock to graze over pasture contaminated by the overflow from dip and draining pens are known to have been factors contributing to arsenic poisoning.

When poisoning occurs, symptoms of acute gastritis with colic, thirst and great weakness, staggering, straining, and so on are quickly apparent. Death usually occurs within a day or two, but stock sometimes die so quickly that symptoms are not noticed.

Cattle and dogs should not be dipped or sprayed in a dip prepared for sheep as the poison may be taken by the mouth or through broken skin.

Directions for mixing dip should be followed carefully. When practicable, administer emetics and purgatives, then, with small animals, milk or egg white. Antidotes are calcined magnesia or ferric hydroxide, but oil with limewater and linseed tea, which are more likely to be readily available, are effective. The dip, of course, should be washed off the skin.

Zinc

Zinc has caused losses mainly of pigs. Main source of the poison is new galvanized piping from which the lining has been dissolved by the acids of stale milk. The zinc passes into the milk in a soluble form. Pigs have been affected on several farms, the symptoms being swelling and tenderness of the joints, with consequent lameness, loss of condition and death. The antidote for zinc poisoning is carbonate or bicarbonate of soda with demulcents such as raw milk or white of egg. Usually, however, the symptoms are noticed after the trouble has gone too far for effective treatment. Prevention should be the aim. The pipes should be washed out with water. The water must be discarded before pumping the milk through to the pig troughs or holding barrel. These precautions are necessary only while

the pipes are new. Once the surface has corroded the danger is past.

Carbolic acid

Carbolic acid, a coal tar derivative, has frequently caused coal poisoning, mainly in small animals. Dogs and cats are highly susceptible to this drug in its various compounds—creosote, phenol, and so on—which are used as disinfectants in skin dressings and for baths. Symptoms are muscular twitchings followed by paralysis, vomiting, and weakness. Death or slow recovery results. The poision can be absorbed through skin broken by scratching or biting, as with dogs suffering from eczema. Trouble is known to have occurred when carbolic soap was used in giving an enema and again when a disinfectant was put in a bath to kill fleas. The lethal dose through the alimentary tract is 1 oz. for a horse and 1 to 2 drachms for a dog. The amount absorbed through the skin cannot be measured. Flesh after death by poisoning will give the characteristic smell. The antidote is Glauber salts (sodium sulphate) administered in solution by the mouth, and, of course, any carbolic on the skin should be washed off with plenty of water.

Strychnine

Strychnine, as a common rabbit poison, is used by many stock owners. Care should be exercised in handling this poison because of the rapid and serious effect it has on farm animals and, indeed, on the careless rabbiter who does not wash his hands before handling food.

At least one farmer is said to have reported his kill after a rabbit drive as 'two hundred rabbits, two dogs, and three pigs'! He had neglected to tie his dogs up until all the rabbits had been collected. He had mixed up the strychnine in a shearing shed also and the pigs had had access to the shed.

Strychnine is present in the seeds of plants such as nux vomica and is used as a tonic and stimulant in medicine. Used for rabbiting, however, it is a white crystalline powder, coloured pink artificially for safety, and in this form is a much more powerful poison.

Symptoms are shown in a powerful stimulus to the nervous system, especially the spinal cord, and tetanic spasms, with curvature of the back, tenseness and quivering of the muscles, are evident. Respiration is arrested and death occurs from asphyxiation. The antidote which must be printed on the poison container is a strong mixture of mustard and water or a strong salt solution to induce vomiting and so get rid of the poison. This should be followed by strong tea or coffee brewed and allowed to stand. Care must be taken that the fluid does not enter the lungs during a spasm. The remedy must be quickly administered. Tobacco and chlorodyne have been found effective as cures.

Caustic soda

Caustic soda has been known to cause poisoning of pigs and calves. Used in and about cow sheds for cleaning machines and so on it is liable to get into utensils for feeding milk. It is a strong alkali and has a corrosive action, burning the tissues of the mouth and stomach. The antidote is a weak acid solution such as vinegar or lemon which should be given at once, although after burning has occurred healing will be slow.

Common salt

Poisoning by sodium chloride or common salt has been reported among cattle, sheep, pigs, dogs, and poultry, the symptoms varying in the different species, but showing mostly in intense pain, dullness, diarrhoea, vomiting, collapse, and death. Sometimes the salt has been fed by mistake or has been added to food for medicinal purposes in excess of a safe amount. Trouble has occurred through rock salt becoming dissolved in rain water caught in troughs, and the strong solution drunk by stock. Water or food containing 1·5 per cent and upwards of sodium chloride have caused symptoms in stock and poultry and should be regarded as dangerous. Treatment consists of giving emetics such as mustard and water, followed by stimulants such as strong tea and demulcents such as milk and white of egg.—Reproduced from *New Zealand Journal of Agriculture*, January, 1946.

The Month's Clip

GRAZING AND PASTURE RESEARCH IN THE CENTRAL PROVINCES

SARDAR BAHADUR SARDAR GURDIAL SINGH LAMBA

THE experimental work done so far in the Central Provinces and Berar is summarized below.

With continuous and unrestricted grazing, the grazing grounds tend to deteriorate. Periodic closures and control of incidence is believed to increase the productivity. In the absence of any data to show optimum grazing closure cycles and incidences, they were arbitrarily fixed and experiments were initiated to see if the prescribed restrictions were actually improving the yield or not. In 1931, a number of one-tenth acre grass plots were laid out in various localities. The yield from them was determined when hand-mown at intervals and when only one cutting was done towards the end of the growing season. The data collected failed to give conclusive evidence whether one cutting or several cuttings were more productive. Fresh plots were laid out in 1932 and assessed. But again the figures failed to produce reliable results. It was realized that the investigation was subject to many vitiating influences and conclusive indications could only be obtained if the experiments were conducted on a large scale for a number of years under the supervision of trained officers.

Effect of closures on grass production

In 1934, a detailed investigation was commenced in the grazing grounds of Saugor and Yeotmal in consultation with the central silviculturist. The treatments under comparison were three intensities of incidence, three site qualities and various grazing closure cycles varying from 1 to 10 years. The layout of the plots was designed to ensure initial comparability and to eliminate the effects of seasonal variations. Nearly 150 one-tenth acre plots were thus assessed during the years 1934-37. An analysis of the data once again showed that the effect of uncontrolled variables completely swamped the variations due to treatments under study. Thus even this elaborate investigation failed to give definite indications regarding the effect of closures on grass production. It however taught us a number of lessons. The chief lesson learnt was that in intricate investigations like regulation of grazing, many vitiating influences such as heterogeneity of the area, climatic variations, etc. are to be contended with. The experiments must be on a large scale and spread over a number of years.

Assessing the productivity of plots

The first obvious step was to evolve a technique for correctly assessing the productivity of any area by an inexpensive method before the effects of two treatments can be compared inasmuch as the treatments must be applied to strictly comparable samples. In 1938, therefore, a fresh investigation was started with a view to find out technique for assessing the comparative productivity of plots of convenient size, viz. 66 ft. and also to determine the number of replications required. An area of about 12·5 acres of grazing ground near Nagpur was selected. The area was divided into 66 ft. × 66 ft. plots. After trying several methods of assessment and assessing various percentages of the plots on different sizes of quadrats, eventually a practical method has been evolved which is summarized below.

A practical method

An area of not less than 6 acres, i.e. sufficient to get 30 replications of the pasture covering the entire range of variations should be selected when the comparative merits of two treatments are to be assessed. The entire area should be divided into 66 ft. × 66 ft. plots. Fifty per cent of these plots selected by drawing lots should be allotted to one treatment and the remaining 50 per cent to the other. Each of these plots may be assumed to be divided into 100 quadrats 6·6 ft. by 6·6 ft. by lines parallel to the plot boundaries.

After the treatments have been applied and the grass is ready for harvesting, preferably

just before seed has ripened, i.e. about November-December, 25 quadrats 6 ft. to 6 ft. should be laid out in each plot by drawing lots and the herbage in each assessed occularly. In the Nagpur Pasture Investigation, the following data was recorded by occular estimation:

I. *Density of stocking*

Very sparse	..	0–50 per cent stocked
Sparse	..	50–75 per cent stocked
Thick	..	75–100 per cent stocked
Very thick	..	Over stocked

II. *The prevailing type of herbage*

(a) Important fodder species
(i) *Sheda* (*Schima norvosum*, stapf.)
(ii) *Mushan* (*Iseilema laxum*, Hack.)
(iii) *Marvel-lahan* (*Dicanthium annulatum*, A. Cassus)
(iv) *Marvel-mothi* (*Dicanthium caricosum*, A. Cassus)
(v) *Bhuijuar* (*Alysicarpus rugosus*)
(vi) *Sheora* (*Indigofera linifolia*)
(b) Less important fodder species
(i) *Kusal* (*Heteropogon contortus*, Beauv.)
(ii) *Ghonad* (*Themeda quadrivalvis*, O. Ktze.)
(iii) *Diwartan* (*Andropogon pumilis*, Roxb.)
(iv) *Gadhasheda* (*Chrysopogon montanus*, Twin.)
(c) Non-fodder species collectively

III. *Percentage area occupied separately by species in the case of types (a) and (b) and collectively for all species in the case of type (c) mentioned above and the percentage of unoccupied area.*

Before the experiment was started it was decided that a 10 per cent significant difference between two treatments would be accepted as showing the superiority of one treatment over another.

The above technique can be employed for comparing the effects of such treatments as burning, weeding at various intensities, harrowing, manuring, reseeding, etc. This technique however cannot be employed for treatments involving grazing or mowing of grass. Further experiments are needed to find out a suitable technique for such treatments.

Subsidiary investigations

Besides the above experiments, certain subsidiary investigations were also carried out. These and the indications obtained from them are given below:

(a) Chemical composition of various fodder species found in the pastures.

Representative samples of certain important species were selected from good and poor localities and chemically analyzed. The analyses show that there is no appreciable difference due to locality factors so far as the organic nutritive constituents are concerned but certain species such as *nushan* (*Iseilema laxum*), *diwaratan* (*Andropogon pumilis*) and *marvel-mothi* (*Dicanthium caricosum*) when grown in good locality are somewhat richer in phosphoric acid than when grown in poor locality. As regards the nutritive value as judged from the non-mineral nutritive constituents of individual species for a given weight of herbage, *diwaratan* (*Andropogon pumilis*) was the best but in the basis of the mineral and non-mineral constituents together, *marvel-lahan* (*Dicanthium annulatum*) was the first followed by *marvel-mothi* (*Dicanthium caricosum*), *nushan* (*Iseilam laxum*), *kusal* (*Heteropogon contortus*) and *sheda* (*Schima nervosum*). On the basis of dry matter and total food units yielded per acre, *kusal* was the best though somewhat poor in phosphoric acid and protein contents showing thereby that if the species is cut a little before the dead ripe stage, it is a valuable fodder. The prejudice against it is mainly due to its being harvested at a period when its lawns have hardened.

(b) Soil samples collected and analysed for mechanical composition, organic carbon, nitrogen content and *p*H value from 'good' and 'poor' sites as adjudged by the herbage growing thereon showed that difference is not appreciable. It would thus appear that the quality of herbage depends on (i) the moisture content of the soil which is greater in deeper soils and lasts longer, (ii) the volume of soil tapped by the fodder species.

(c) Samples from herbage collected from areas carrying the following types of pastures were analyzed.

(i) Best type found on fairly heavy and moist soils (*nushan-marvel* consociation),

(ii) medium type found on coarse but still fairly deep soils (*sheda-kusal* consociation), and

(iii) poor type occurring on very poor and shallow soils (*bhurbhuri-diwartan* consociation).

These showed that there was no correlation between total exchangeable bases and the nutritive value of the herbage produced. The variation is due to causes other than the mineral composition of the soil, probably due to moisture contents.

The herbage was also analyzed for mineral

and non-mineral constituents and the value of food-units. These analyses did not justify any useful conclusions. In fact they failed to show the comparative obvious merits of the three types.

(d) Succession. Changes in the composition of herbages were also noted as a result of closure and annual cutting after seeding. These showed that in the first year or two the proportion of *Cassia tola* decreased and that of *kusal* (*Heteropogon contortus*) and *sheda* (*Schima norvosum*) increased. In the next year *sheda* increased suppressing even *kusal* but allowing *nushan* and *marvel* to come underneath it. At this stage the pasture is at its best. It begins to deteriorate on further closure as the coarser grasses (*Themeda quadrivalvis*) and *phulkis* (*Alpuda varia*) appear and begin to spread.

Immediate problems

The problems of immediate importance to this province requiring investigation are:

(i) Determination of a suitable technique for assessing pastures when the treatment to which they are subjected involve grazing or hand-mowing of herbage.

(ii) Determination of the effect of the following treatments on pastures with due regard to the costs involved.

(a) Burning before the growing season.

(b) Shrub-cutting and weeding of non-fodder species.

(c) Draining, soil working and manuring.

(d) Closures to grazing for 1, 2, 3 and 4 years respectively and annual grass cutting just before the dead ripe stage.

(e) Effects of division of the pasture into blocks and permitting grazing in the blocks for a day, say on 7 days cycle.

(iii) Determination of the optimum grazing closure cycle.

(iv) Determination of the effect of control of incidence.

Suggestion

It is suggested that a special section to deal with pasture and grazing problems should be created and put in charge of an agrostologist as the silviculturist has a number of other problems to investigate. The agrostologist should be provided with adequate staff, funds and equipment to efficiently carry on the work entrusted to him.—Reproduced from *The Indian Forester*, December, 1945.

PROSPECTS FOR FISHERIES

WITH a long coast-line of well over 3,600 miles and the rich deltas of big rivers such as the Ganges and the Indus and numerous lakes, tanks and ponds, India possesses plentiful resources of potential supplies of fish. Fish is a nutritive food containing as it does certain vitamins and mineral salts. Its protein content equals that of meat and it takes an important place among the protective articles of food. In a country like ours, where the average man is accustomed to a cereal diet which is ill-balanced and where the intake of meat and milk is very low, fish would serve as a vital supplement. The results of a marketing inquiry held in 1941 showed that the annual production of fish stands at 17,930,000 md. or 658,707 tons approximately. Of this quantity two-thirds is sea fish and one-third inland fish. At present the per capita consumption of fish in India is about 3 to 4 lb. or roughly 0·2 oz. per day. In view of the small quantity of meat and milk consumed by the people, the intake of fish ought to be increased to 2 to 4 oz. daily. Happily, there is not the same prejudice against fish-eating as exists in respect of meat and hence the total production can be safely increased ten times the present output to cope with the requisite demand.

A neglected Industry

Fish culture and fish farming have been practised in India since the ancient times, but there are perhaps a few industries so neglected as fisheries. The industry is entirely in the hands of a backward community dominated by powerful classes of creditors and middlemen. Indian fisherman follow obsolete, traditional practices and show little inclination to make improvements or to strike new paths. Their activities are limited and characterized by a lack of enterprise. The bountiful resources of deep sea fish have never been tapped and the scope of fishing operations has not extended beyond 10 miles of the coast. Even in routine matters there is the same aversion to progress. The types of nets and other materials used,

the methods of drying, curing, preservation, handling, packing, transport and marketing are the same as have been handed down over generations. This has been the state of affairs while the industry is left to the feeble efforts of an ignorant and poor class of fishermen; but in recent years even with State encouragement very little progress has been made. In Bombay and Madras trawler experiments were made to increase the quantity of catch, but they failed chiefly because there was a paucity of trained persons, suitable vessels, data regarding fishing grounds, their movements and habits. The problem of fisheries must be tackled from different angles such as scientific investigation and culture, marketing re-organization and amelioration of the condition of fishermen. The outstanding needs of the moment are suitable vessels, refrigeration facilities, scientifically organized yards for curing fish, and improved means of transport both up to landing places and market centres. Fish is a highly perishable commodity and in the absence of cold storage facilities it has been found that hardly about 25 per cent of the catch is consumed as fresh fish. The processes of drying and curing are most unhygienic and wasteful. Improvements must, therefore, be directed towards proper conservation, processing and transport. It is somewhat gratifying to learn that recently the Government of India have decided to purchase fishing boats and ice-freezing plants worth about Rs. 15 crores from Canada.

A potential source of income

Besides serving as an article of diet, fish provides means of income in many other ways. During the war shark liver oil industry made notable progress and it has been observed that it constitutes a good substitute for foreign cod liver oil. The new industry must be put on a sound basis so as to meet the inevitable competition of imported cod liver oil and vitamin A concentrates. Laboratories should be set up and research conducted to improve the methods of collection and extraction with a view to increasing its commercial utility. Side by side with research, measures must be taken to ensure good quality and to prevent the slaughter of young sharks. The chief by-products of fish include raw materials for medicinal and industrial oils and fish manure. In the coastal and deltaic regions fish culture would provide a profitable spare-time employment.

Need for research

Endorsing the recommendation of the Fish Sub-Committee of the Policy Committee on Agriculture, Forestry and Fisheries, the Famine Inquiry Commission in their final report lay great emphasis on scientific knowledge and its application to the industry. No plan of development of fisheries can be complete without a comprehensive and far-reaching programme of research. In fact this is the real basis of a successful and productive fishing industry. Research is essential so that resources may be properly estimated, most valuable grounds discovered and charted and plans based on exhaustive knowledge of fish distribution, migration and life history. The Commission point out the precedent of the U.K. and the U.S.A. and rightly urge that the real incentive must come from the Government for intensive research with generous State aid so that the industry may be put on a commercial basis. The question of fishing craft and existing methods of culture also needs thorough investigation.

Central Fishery Research Institute

The organizational aspect of the reconstruction of fisheries has been stressed by experts over and over again. The recommendations of the Fish Sub-Committee envisage the establishment of a Central Fishery Research Institute with two marine and three inland research stations. The cost is estimated at Rs. 60,00,000 and the recurring expenditure at Rs. 15,00,000. Provinces and States are also exhorted to open their own research stations. The Central Research Institute would be charged with the function of carrying in various types of research, training workers and coordinating the activities of the provincial and State research stations. The actual task of introducing improved methods, organizing local fishing industry, improving means of storage and transport is of course a provincial responsibility. The existing staff of fishing departments in the provinces and States is inadequate and untrained and will require great expansion. Not only trained experts and research units are necessary, but a large force of trained ground staff is a matter of no less importance. The lack of trained workers is, in fact, a serious handicap to the growth of our fishing industry. It is also suggested that the immediate need in this regard can be effectively met by sending a number of scholars

for training at the Torry Research Station, Aberdeen, and that until an adequate number of Indians is trained, foreign experts, who have specialized in fishery problems of the tropics, should be engaged as an item of the short-term scheme. These are not platitudinous suggestions but an emergent necessity as thousands of workers will be requried if the industry is to be put on an expanding and progressive basis. The position has been succinctly expressed by the Famine Inquiry Commission : 'On the one hand, there is a primitive community using primitive and inefficient methods; on the other, potentialities which can be realized only by re-organization on scientific and modern lines. The challenge must, however, be met. We ourselves place strong emphasis on increased production of fish as a very important part of the programme for improving the diet of the population'. The challenge can certainly be met, but not by moving at a snail's pace and marking time in considering schemes on paper.—Reproduced from *The Eastern Economist*, November 30, 1945.

FUTURE OF COTTON INDUSTRY IN U.K.

THE maintenance of the cotton industry as a major national industry under private enterprise is the keynote of the report of the Cotton Working Party issued on 27 May 1946. A wide programme of re-equipment and reorganization is set out in 34 recommendations which range from proposals for an immediate survey of the existing machinery and independent investigation of the textile machinery of the industry to the formation of a Central Cooperative Marketing Company for further experiments in the utilization of labour and a central factory owned by the industry to try out new methods of production on a commercial scale. The Cotton Working Party, appointed in October 1945 by Sir Stafford Cripps as President of the Board of Trade, consists of Chairman, Sir George Schuster, four employers and four trade unionists drawn from the main sections of the industry, together with four independent members. After reviewing the industry's difficulties in the inter-war years, the report says that workers available are likely to be less than two-thirds of the numbers required to man existing plant by pre-war methods.

Lancashire must, therefore, produce on a competitive basis with a relatively small highly paid labour force, using improved machinery giving higher output per worker. There must be greater continuity of production, more efficient use of labour and shift work and the industry must gradually be equipped with greatly increased number of modern spindles and looms capable of producing substantially more than the present output. A Central Cooperative Marketing Company is recommended as a practical step to close link-up between producers and distributors. To coordinate the application of these proposals, the report recommends appointment of a Cotton Council which would take over the functions of the present Cotton Board.—Reuter, London, May 29, 1946.

New Books and Reviews

THE FIELD PUBLICITY ORGANIZATION

(Issued by the Central Office of the Field Publicity Organization, Department of Information and Broadcasting, Government of India).

WITH the cessation of hostilities, the different post-war plans for the improvement of rural India are awaiting execution. For working out these plans in an efficient manner the people, for whom these welfare measures are meant, should be told about these. For it is on the understanding and cooperation of the villagers themselves that persons charged with the welfare work must to a great extent depend. Publicity should *therefore form an integral part* of these post-war developmental schemes. The brochure under review provides an excellent guide which will go a long way to make publicity work in villages easy, effective and systematic. The aim should be to develop in the villagers a desire to work of their own accord for better villages. This can be achieved by educative publicity, by stimulating and canalizing the energy, interest and enthusiasm of the people for better living.

The problem is the medium through which can such educative programmes be brought to the notice of those for whom they are meant. Obviously film publicity, 'the best form of audio-visual publicity' is the most helpful means of providing authentic information. Since the supply of information films must necessarily be limited these can be supplemented by lectures, illustrated by lantern slides or pictures. Exhibitions and demonstrations are important in visual publicity and competitions and shows are 'the strongest stimulant and spur to development effect'. A consideration of various other means of propaganda has also been included. A comparative estimate of different methods of propaganda has been given and the suitability of particular types for particular occasions or for particular purposes emphasized. Entertainment may be profitably combined with propaganda through dramas, songs and broadcasting of rural programmes.

A scheme of Field Publicity Organization, the 'F.P.O.', has been given and the functions of each office defined. "The 'F.P.O.' consists of a Central organization with the Government of India which acts as an initiating, guiding and coordinating agency and, in the provinces, Provincial Organizations which form a branch of the Provincial Publicity under the Provincial Government.........the basis of the Provincial Organization is a fleet of Mobile Publicity Units of which, as the first stage, one unit is based in each civil District". The District Unit, happens to be the foundation of the 'F.P.O.'. 'The Unit comes under the general administrative control of the District Officer'.

Plans for conducting well-conceived and carefully organized publicity campaigns have been set out in great detail. Each campaign must have a definite object and a clear-cut plan of action; all the possible means of propaganda ought to be utilized to gain the objective.

There is a valuable appendix to the booklet giving instruction regarding the management, administration and control of the 'F.P.O.'. The duties of the staff have been detailed therein and the proper maintenance of all equipment has been stressed.

The brochure is well-written and neatly printed with an attractive get-up. It is a useful publication and may very well serve as a veritable text and reference book to all persons interested in publicity work.—U.N.C.

YOUR FOOD

By M. R. MASANI (Tata Studies in Current Affairs. Published for Tata Sons Limited by Padma Publications Ltd., Bombay, pp. 82, Re. 1)

THIS is a welcome volume from the pen of the author of the well-known book, *Our India*. Mr Masani discusses in this book the problems of food and nutrition in India and has been amazingly successful in bringing to our notice facts and figures relating to the subject.

The author opens the subject by pointing out the paradox that, notwithstanding the fertility of our soil and our huge man-power and livestock population, 'India is not able any longer to feed those who inhabit this country'.

Chapter 2 deals with the various constituents of food and Chapter 3 with the food requirements of human beings. The nutritive values of various kinds of food form the subject matter of Chapter 4. The predominantly vegetarian dietic habit of Indian people has been attributed to the fact 'that an acre of land can feed a larger number of mouths if it produces foodgrains than if it is used for feeding cattle, sheep or poultry for consumption in the form of meat . . . . . It is only natural that India which is by and large one of the most densely populated countries in the world, should be a vegetarian country, primarily because it cannot afford to be anything else'. The problem of a balanced diet has been discussed in Chapter 5 and that of Indian diets in the following chapter. The deficit in the supply of our foodstuffs has been glaringly brought out in Chapter 7; the author writes 'If we were to decide that all Indians should eat an adequate diet, *there would be no food at all for about 115 million of our people*'. As a result of this inadequacy of food a newly born Indian baby can 'expect to live only for 27 years'. We often hear of the rising tide of population in India as being one of the potent causes of famine and starvation. On this point the author states 'While no doubt the number of Indian mouths to feed has gone on increasing at a good pace, it would be wrong to think that we alone of all the peoples in the world have increased in number. Indeed our rate of increase appears to be quite modest when compared with that of several other countries in the last half-century'.

Dealing with the 'grow more food' campaign the author adduces causes which, in his opinion, have stood in the way of a noticeable increase in the actual production of food grains and suggests ways and means to effect improvement. Growing of more food is not an end in itself; proper distribution and marketing of foodstuffs, as the author points out, 'can make all the difference between satisfaction and starvation'. The innumerable ways in which the nutritive elements of our foodstuffs are entirely lost or, at any rate, considerably diminished either before or at the time of cooking have been clearly indicated. Among the main factors contributing to ill-balanced and deficient diet of our people, poverty is the outstanding one. The author has given data obtained in an investigation carried out among the employees of Tata Iron and Steel Works at Jamshedpur which show that 'as the worker's income rises, he eats better and more varied food'.

Apart from its neat printing and nice get-up the illustrations form a special feature of book. The illustrations are tell-tale pictures depicting some of the statements made in the text and form helpful visual aids for a thorough grasp of the subject matter.

The book is written in a pleasant style and provides an entertaining reading. It well deserves to be read by every person interested in the subject.—U.N.C.

ERRATUM

Indian Farming, Vol. VII, No. 3, March, 1946, page 129, Fig. 1:

The sequence in the histiogram index should read as under:

Rinderpest
Foot and Mouth
Black Quarter
Haemorrhagic Septicaemia

From All Quarters

IMPORTANCE OF SCREENING

OF the various methods of insect control mechanical measures are sometimes the most practical and effective. These methods do not involve elaborate equipment and therefore are popular. Screening of grain is one such method for the reduction of infestation and prevention of damage to foodgrains.

Screening is generally practised by cultivators as well as by the trade when foodgrains are infested, but the care and attention with which it has to be done is not observed with the result that the very purpose of screening is sometimes defeated. Screening can be easily adjusted in the routine of godown management.

The advantages of screening are:

(1) It removes a large proportion of the insect population from the infested grain.

(2) The dirt, frass and other waste matter is removed from the grain giving it a more attractive appearance.

(3) Screened grain will pass as a fair average quality grain though it may not be insect free.

(4) When grain is moved from one place to another or from docks or railway sidings to godowns it prevents to a great degree the spread of insect infestation.

Hand screening by sieves is the usual practice but when large quantities are involved this method is not practicable. Screening machines are, therefore, recommended. These machines are quite simple in structure and easy to operate; they consist of two sieves, each fitted on a frame one fixed over the other; the upper sieve has a large mesh and the lower one a small mesh. There should be a waste hole to the upper sieve to which a bag or container can be fitted. The machine should be adjusted at an angle to ensure that the flow of grain over the sieve is neither too quick nor too slow. If the sieves are mechanically operated there would be a considerable saving in time and labour.

Another method of cleaning grain is by means of a winnower. There are simple designs with a fan fitted in a chamber; as the grain is poured from the top it is winnowed and the insects, dirt and frass are blown out at one end and the sound clean grain falls through an outlet where a bag can be tied. Care has to be taken that the waste is at once swept up and removed. The cost of the winnower, if locally made, is about Rs. 200 and with 8 hours working day, about 250 bags of grain can be winnowed. A sample of a winnower can be seen at any Government Farm.

Screening should be a regular practice and grain should not remain unscreened unless it is absolutely clean and uninfested. Sites for screening should always be selected at a distance from the main store. If, however, for certain local reasons screening has to be done near the godown the latter must be kept properly closed during screening operations. When a number of screening machines are in use at the same site a reasonable distance should be kept between each. This is necessary to avoid congestion and accumulation of waste and insects. Screenings should not be allowed to accumulate in heaps but should be removed at once and burnt. Accumulation of screenings results in the collection of a large number of insects and their larvae and eggs. The adults fly or migrate to nearby grain stocks. The practice of collecting the screenings for sale for feed to cattle or poultry is to be condemned. The sale of screenings may produce a small cash income but the loss involved by the spread of infestation gives rise to greater loss in the long run. Prompt disposal and destruction of waste material should be planned out before screening is commenced. Bags used to carry screenings should not be used for storing either screened or cleaned grain, nor should they be kept in godowns containing sound or screened grain.—*B.P.I. Press Note*, February, 1946.

GOVERNMENT OF INDIA INLAND FISHERIES TRAINING COURSE

The results of the Government of India Inland Fisheries Training Course (second batch) are given below.

In order of merit

Distinction—65 per cent and above (i.e. 325 and above)

Name	State or Province	Marks obtained
1. T. V. R. Pillay	Baroda	398
2. Raj Behari Lal	Jaipur	383
3. Anil K. Mukherjee	Bengal	339
4. P. C. Chatterjee	Ajmer-Marwara	337
5. Augustine David	Mysore	328

Name	State or Province	Marks obtained
Credit—55 per cent to 64 per cent (i.e. 275 to 324)		
6. S. A. Kabeer & C. L. Kewalramani	Hyderabad Sind	311
7. R. A. Humayun	Hyderabad	301
8. Magsood Shah Khan	Hyderabad	297
9. Md. Yusuf Ali	Bengal	295
10. Joy Chandra Patra	Orissa	294
11. S. K. Sen Gupta	Cooch-Behar	289
12. A. Latieff	Punjab	285
13. S. B. Devadhar	Bombay	284
14. M. A. Poonapa	Coorg	283
15. A. G. Kalawar	Bombay	281
16. B. N. Prasad	Bihar	276
Pass—40 per cent (i.e. 200 to 274)		
17. A. Naik	Patna	252
18. M. I. Ittanpilla	Cochin	239
19. A. N. Bagchi	Nandgoan	234

COVER ILLUSTRATION

The illustration on the cover depicts a poultry pen of improved pattern. (*Courtesy of the Director of Veterinary Services, Madras*).

DWIJADAS DUTTA, B.Sc., M.S.A. (Cornell)

PLATE 30

DWIJADAS DUTTA

An Appreciation

IT is with the deepest regret that we record the death from pernicious anaemea of Mr Dwijadas Dutta, B.Sc., M.S.A. (Cornell) late Second Economic Botanist, Bengal. The melancholy event took place on 5 April 1946.

Mr Dutta came of a respectable Kayastha family of Mymensingh in East Bengal. He was all along of a studious disposition and after obtaining his B.Sc. degree from Presidency College, Calcutta, he joined the Agricultural Section of the Sibpur Engineering College and passed out with credit. He was a student of late Sir P. C. Ray who considered Mr Dutta as having few equals in tne sound grasp of the subject which he chose for his profession. In those days students successfully completing the agricultural course were eligible to the Provincial Executive Service but Mr Dutta gave up the temptation of a lucrative post and accepted a scholarship in order to fulfil his desire for higher studies at Cornell in the United States. There he took the Master of Science Degree in agriculture and was very highly spoken of by his professors. He availed the opportunity of extensively travelling in America, visiting experimental stations, farms and various places of agricultural interest. On his return journey he studied as a casual student in the London University and visited the Oxford, Cambridge and Birmingham Universities.

Finally returning to India he first started a private farm at Chittagong but various difficulties hampered his work. Meanwnile he was offered a post in the Bengal Agricultural Department in which he rose to officiate as the First Economic Botanist in place of Dr Hector. In this capacity he did the spade work of what is now the Bengal Agricultural Institute. Subsequently he was permanently put as Second Economic Botanist and in this capacity he carried out investigations on cotton, oilseeds, pulses, fodder crops and deep water paddy. He isolated one variety of cotton from Dewangunj, which resembled Dr Roxburgh's description of Dacca muslin. He collected samples of fodders from different parts of the world, as far away as Manchuria and America, and the then Director of Agriculture, Mr Finlow, was so impressed with his work that he remarked in the annual report that it is little or no exaggeration to say that in this respect he (Mr Dutta) has brought the rest of the world under toll to Bengal. His work led to the introduction of Napier grass as a fodder in Bengal. One of the strains of linseed B14 had the same percentage of oil as Pusa types and yet gave a heavier yield. His selection of deep water paddy gave an increased outturn of 16 to 24 per cent.

While at the Dacca Experimental Farm he felt, that there was great need for a forum of intellectual recreation and an institution under the name of Bengal Agricultural Intelligence Club was started with Mr Dutta as President and Messrs I. Chatterjee, T. N. Roy, K. C. Banerjee, and A. L. Mukherjee as Secretaries. The work of Mr Dutta in this connection was also highly eulogized by Mr Finlow.

Mr Dutta's activities were also directed to other useful spheres. The Dacca farm was then situated at a more out of the way place than it is now. With commendable energy and spending largely from his own pocket, he started a Polytechnique School teaching up to matriculation standard on one side and imparting instruction in agriculture, carpentry, smithy, etc. as well on the other. Happily the school is still in existence bearing testimony to the public spirit of its founder.

Mr Dutta had three sad bereavements, first in the death of his eldest daughter and only recently by the death of two of his sons within an interval of few days. He is survived by his widow, two sons and three daughters.

Our heart-felt condolence goes to the bereaved family.—I.C.

Original Articles

RESEARCH ON COTTON IN THE PUNJAB

I. *DESI* COTTONS

MOHAMMAD AFZAL

Cotton Research Laboratory, Lyallpur

THE Punjab Department of Agriculture was established in 1907 and work on the improvement of different crops was taken in hand soon afterwards. So far as cotton is concerned, the mixed crop was first of all classified into agricultural types, a line of work which was popular in India up to the early twenties. A few pure varieties were later isolated. These varieties, bred at Lyallpur, did not suit the different ecological tracts and need was, therefore, felt for organizing the work of cotton improvement on a more extensive scale. For this purpose the Punjab Botanical Research Scheme, jointly financed by the Indian Central Cotton Committee and the Punjab Government, came into being in September, 1925, and work was started on up to date scientific lines.

As has been said above, it was realized very early that one variety of cotton, whether *desi* or American, will not suit the whole of the cotton belt of the province on account of differences in soil and climatic conditions. Need was, therefore, felt for establishing breeding sub-stations in the different ecological regions. The first sub-station at Multan was established in 1935. The Khanewal sub-station came into being in 1937 and two more, one at Jhang and the other at Hansi, were added in 1941. The Jullundur sub-station was added in 1945. These sub-stations are situated in convenient places inside the different ecological zones and it will not be out of place to give a brief account of the ecological zones and the peculiarities of varieties required for each tract.

Ecological zones and peculiarities of varieties

The canal colonies: The districts of Lyallpur, Sheikhupura, Jhang, Shahpur and part of Gujrat comprise the canal colonies. The Punjab has the biggest canal-system in the world and the water of the five rivers instead of running into the Arabian Sea, has been diverted into a huge canal-system which has made it possible to bring millions of acres of arid waste lands under cultivation. The soils are of alluvial origin, light loam in texture and usually more or less impregnated with alkali salts (mostly calcium chloride and calcium sulphate) in the sub-soil. Inspite of this, the soil is normally capable of bearing bumper crops. The climate is dry with a rainfall of 10 to 15 in. per year. The *desi* cotton of the tract is an *arboreum* cotton with broad leaves, white flowers and of medium earliness.

The south-western tract: This zone consists of Multan district and parts of Muzaffargarh and Dera Ghazi Khan. The soil is very heavy in texture, is highly retentive of moisture and is in some parts liable to flooding by hill torrents during monsoon. The soil in this zone is also, at places, impregnated with alkali salts. The climate is extremely dry and hot and the average annual rainfall is only 5 to 10 in.

The *desi* cotton of this tract is the red-leaved *arboreum*, locally known as *Multani* cotton.

The Khanewal sub-division of Multan district, although technically in the south-western zone, has much lighter soil with shifting sand dunes. Here *Mollisoni* cotton is usually grown.

The Central Punjab: The rich, thickly populated and intensively cultivated districts of Lahore, Amritsar and part of Jullundur and Ferozepur in the Central Punjab form an ecological zone by themselves. In part canal-irrigated, in part irrigated by wells and partly *barani*, the rich alluvial soil of this zone is capable of bearing very good crops and of maintaining a very high density of population. Cotton is not an important crop in this tract.

The sub-montane tract: This is a long narrow strip of land at the foot of the lower Himalayas and the Shiwalik range, consisting of the districts of Ambala, Jullundur, Hoshiarpur, Gurdaspur, and Sialkot. This zone includes some of the richest lands in the Punjab. It is

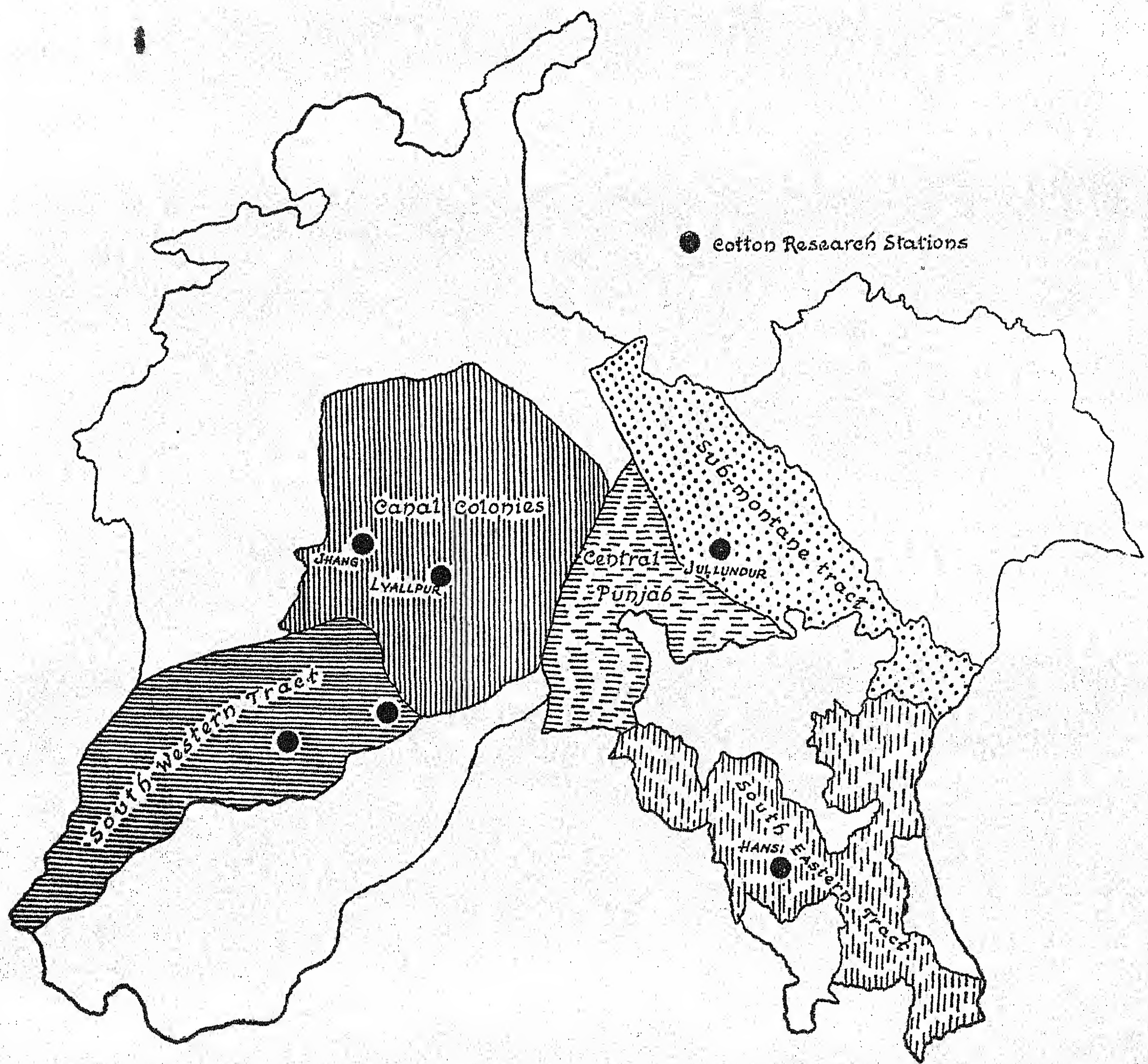

FIG. 1. Map of the Punjab showing ecological regions and cotton research stations

mostly well-irrigated but a large part is rain-fed. The rainfall is about 25 to 35 in. in the year. Although cotton is not an important commercial crop in this tract, most of the cultivators grow a small area for home consumption. The crop as at present grown, is a mixture of a large number of *arboreum* types.

The south-eastern region: The districts of Hissar, Karnal, Rohtak, and Gurgaon in the south-east of the Punjab form a distinct zone. The crops are mostly rain-fed and the canal water supply whenever available is very meagre, as the canals are run in rotation for about 10 days in the month. Only *desi* cotton is grown, but recently a new selection of American cotton has been developed which seems to suit large areas in the tract.

The area under desi *cotton*: The area under *desi* cotton in the Punjab during the last twenty years is given in Table I.

TABLE I

Area in thousands of acres under desi *cotton in the Punjab*

Year	Area	Year	Area	Year	Area	Year	Area
1925	1554	1930	1327	1935	1497	1940	1267
1926	1389	1931	1396	1936	1548	1941	1243
1927	1091	1932	1113	1937	1695	1942	735
1928	1534	1933	1640	1938	1347	1943	762
1929	1402	1934	1506	1939	1209	1944	704

It will be seen that the area under *desi* cotton in the Punjab is very considerable. The abrupt fall in the area in 1942 was due to the present war which made the export of *desi* cotton impossible and stocks of short staple cotton started piling up in the country with the consequent decline in the price of these cottons. It has been estimated that the stocks of short staple cotton held by the trade on 31 August, 1944, were 23,00,000 of bales. The internal consumption of these cottons is in the neighbourhood of 12,00,000 of bales per annum. Thus, if no more short staple *desi* cotton is produced in India, the demands of the Indian mill industry will be met with from the present stocks for the next two years.

The present international conditions appear to indicate that the Indian short staple crop is not likely to be in much demand in the international market and its price will consequently decrease. It is, therefore, imperative to look ahead and try to produce varieties of *desi* cotton with a better staple.

The objects of breeding *desi* cottons in the Punjab should, therefore be (i) to improve yield and ginning outturn, and (ii) to improve staple length. These two aspects of the problem have been dealt with in some detail below.

Improvement in yield and ginning percentage

As the varieties of cotton, grown in 1925, were quite impure, the work of single plant selection and building up of new strains was started afresh. The then prevalent method of 'pure line' culture was adopted and quick results followed. It would, however, be more convenient if instead of discussing the new varieties in a chronological order, an account is given of the best varieties produced for different regions of the province.

The canal colonies: The first variety of *desi* cotton which was approved for general distribution in 1930 was *15 Mollisoni.* This was soon superseded by *39 Mollisoni* which holds the field today. This is an early maturing, high yielding and high ginning (34 to 35 per cent) variety which is prized both by the farmers and the trade. The area under this cotton had a phenomenal rise and in the late thirties it covered an area of about 500,000 acres. Its lint has been adjudged as capable of spinning 8 to 10 highest standard warp counts.

The south-west Punjab: Here the red *arboreum* cottons, locally called *Multani*, are grown. These cottons were, however, badly mixed up. One variety isolated from these, namely, *119 Sanguineum* has proved to be a very high yielder with a ginning outturn of 36 to 38 per cent. The fibre is short and rough and is capable of spinning 6 to 8 highest standard warp counts. This variety is steadily replacing the mixed *desi* cotton of the tract.

119 Sanguineum is an extremely early maturing cotton which gives its last picking by the end of November. This is a point of great advantage as most of the area in this tract is served by inundation canals or hill torrents and late irrigations to the cotton crop are not possible.

The south-eastern region: The present *desi* cotton of this tract is *M 60A2.* Work on the improvement of this variety was started only in 1941 and, therefore, it is not yet possible to give the final results. The indications, however, are that either *231 Rosea* or *258 Mollisoni,* both of which have been giving statistically higher yields than *M 60A2* in the varietal test plots, will be able to replace this cotton in the near future. The ginning outturn of the new strains is also as good as, if not better than, *M 60A2.*

It will be seen that several high grade *desi* cottons have been produced which are being very extensively cultivated in different parts of the province. There are in addition to these several still better strains in various stages of trial and, as time goes by, some of them are sure to replace the present varieties.

The comparative yield and ginning outturn of these improved strains as compared with the local mixtures as well as their technological properties are given in Table II.

TABLE II

Yield and technological properties of new strains

Name of the improved strain	Average yield of *kapas* per acre		Average percentage of ginning outturn	Average lint length in inches	Spinning counts	Region for which found suitable
	Improved strain	Standard				
15 *Mollisoni*	14·91	13·48*	35	0·68	8	Canal colonies but has been replaced by 39 *Mollisoni*
39 *Mollisoni*	14·96	14·17†	34-35	0·74	8-10	Canal colonies
119 *Sanguineum*	22·58	20·43‡	36-38	0·69	6-8	Multan, Muzaffargarh and D. G. Khan
231 *Rosea*	17·56	16·32¶	43	0·64	6	Hissar, Rohtak, Gurgaon and Karnal

* *Mollisoni* mixture, †15 *Mollisoni*, ‡*Sanguineum* mixture, ¶ *Mollisoni* 60A2.

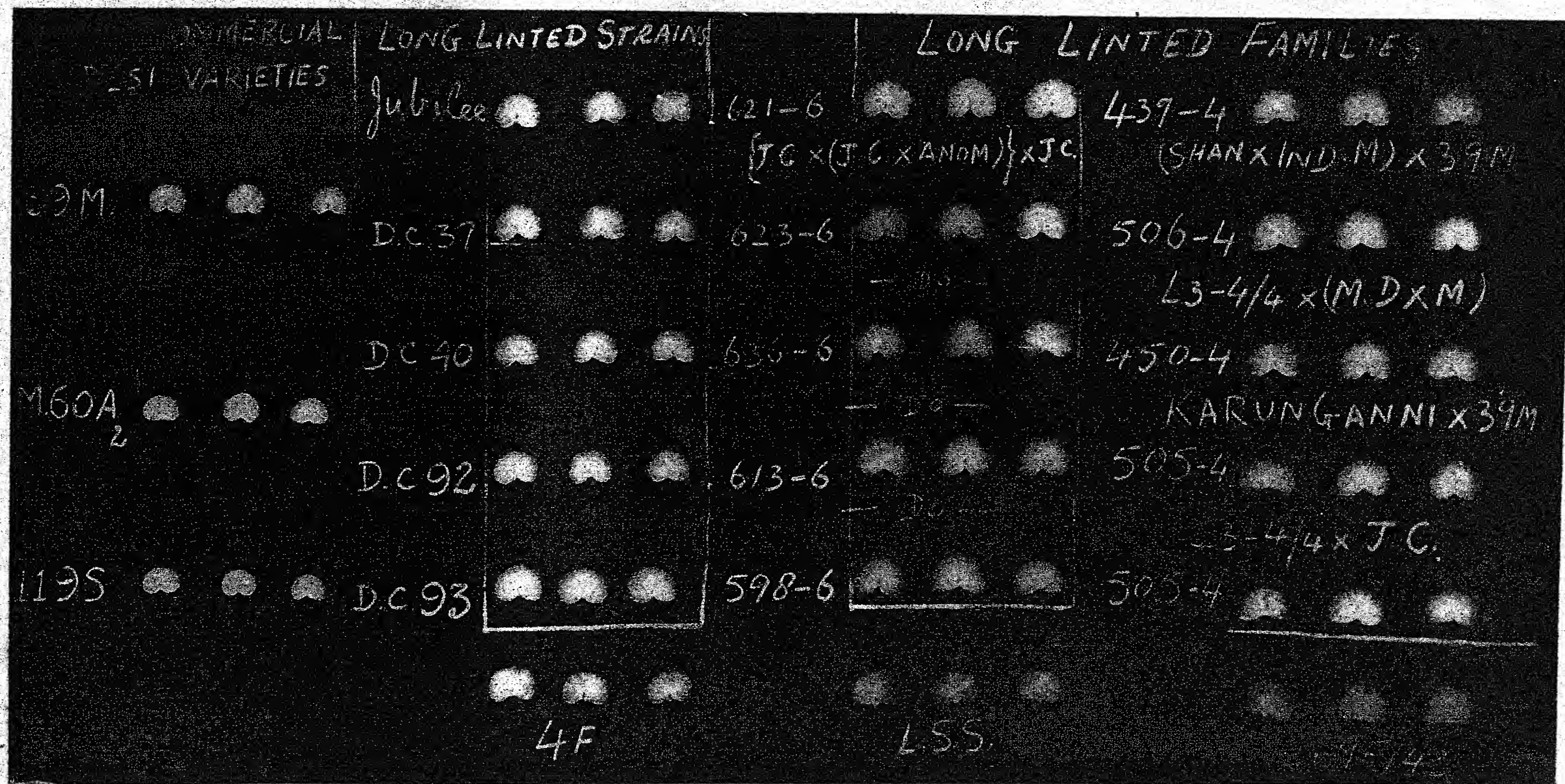

FIG. 1. Different stages of improvement in staple length of *desi* cotton

PLATE 31

Improvement in staple length of desi *cotton*

A census of the consumption of raw cottons by the Indian mills shows that the demand for cottons spinning above 20 counts is going up and it is, therefore, necessary for research workers on cotton in India to produce varieties whose lint will be capable of spinning these counts. It has been stated above that the Punjab *desi* varieties are, one and all, capable of spinning not more than 10 counts. Experiments to improve the staple of these cottons were started in 1930, when the Punjab *Mollisoni* was crossed with the Chinese *Million Dollar*. A large number of strains collectively called *Jubilee* have been isolated. These strains have been tested extensively in randomized varietal test plots and the results of yield and other characters for two years have been given in Table III.

TABLE III

Comparative figures of yield and other characters of Jubilee strains and Mollisoni

Year	Characters	Strains: *Mollisoni*	D.C. 17	D.C. 26	D.C. 37	D.C. 40	D.C. 41
1941-1942	Yield per acre in maunds	21·98	16·99	16·71	17·77	18·02	16·77
	Mean fibre length in inches	0·69	0·75	0·75	0·79	0·76	0·78
	Ginning outturn per cent	35·9	38·1	37·9	40·7	40·9	39·8
	Highest standard warp counts	7	16	19	21	24	15
	Cash return per acre in rupees	..	175·9	180·7	198·9	218·2	180·0
1942-1943	Yield per acre in maunds	14·16	14·28	15·03	15·60	15·46	15·06
	Mean fibre length in inches	0·73	0·78	0·77	0·82	0·84	0·76
	Ginning outturn per cent	34·7	36·4	34·7	36·8	37·3	34·7
	Highest standard warp counts	9	16	20	19	26	21
	Cash return per acre in rupees	245·1	309·7	314·7	374·2	371·8	315·4

Although the yield of *Jubilee* strains is some what lower than *Mollisoni* yet all the other characters show a decided improvement which is ultimately reflected in the higher cash return per acre. Of all the *Jubilee* strains *D.C.37* and *D.C.40* have so far given the best results and the Punjab farmers will be well-advised to grow these instead of *Mollisoni*. Efforts are now being made to extend the area under this cotton.

Jubilee cotton has been very extensively tested by technological laboratories and mills and all have expressed a high opinion about it. The following appears in the *Third Annual Report* of the Lancashire Indian Cotton Committee.

'It will be readily understood that it is, of course, impossible in the space available to recount in detail all the investigations that have taken place or to give more than the barest outline of the results that have been obtained. Mention may, however, be made of two new interesting hybrid types that have recently been developed at Lyallpur in the Punjab by crossing *Mollisoni*, the improved Punjab-*desi* cotton with the high yielding, medium-stapled Chinese cotton known as *Million Dollar*. The exhaustive spinning tests that followed have shown that the two hybrids ....are both superior to *Mollisoni* itself.'

The staple of *Jubilee* cotton is being improved still further by crossing it with the wild Nigerian *Gossypium anomalum*. This cross was made in 1938 and the F_1 was backcrossed twice with *Jubilee* to regain the genetic balance. The strains developed from this cross are now undergoing final tests. The different characters of these strains are given in Table IV.

TABLE IV

Yield, ginning outturn and technological properties of Jubilee × anomalum *derivatives (1944-1945)*

Characters	*Jubilee*	39 *Mollisoni*	*Jubilee* × *anomalum* derivatives				
			D.C. 92	*D.C.* 93	*D.C.* 94	*D.C.* 95	*D.C.* 96
Yield in maunds per acre	15·37	18·46	17·23	17·74	17·50	16·58	17·18
Ginning outturn per cent	36·7	33·7	36·0	36·5	38·2	39·0	37·5
Mean fibre length in inches	0·78	0·71	0·83	0·87	0·88	0·84	0·84
Fibre mass per unit length (10^{-6} oz. inch)	0·220	0·281	0·211	0·216	0·200	0·231	0·214
Calculated spinning counts	18	8	24	25	29	23	23
Evaluation per candy	486/–	251/–	611/–	586/–	601/–	604/–	631/–
Calculated cash return per acre in rupees	328·3	222·9	446·2	446·0	463·2	446·7	469·4

It will be seen from Table IV that hybridization of *Jubilee* with *anomalum* has produced results of great economic importance and these strains, when given out for cultivation will revolutionize the *desi* cotton industry of the province. It will be seen that the material at present available shows great potentialities. The fibre length of the new strains compares very favourably with Punjab-American varieties.

The above is a brief account of the research work which has been carried out on *desi* cottons in the Punjab with the financial assistance of the Indian Central Cotton Committee during the past twenty years. It will be seen that both the yield and the spinning qualities of *desi* cottons have been improved considerably and the prospects of a change-over from the production of short staple *desi* cotton to medium staple *desi* cotton are very bright. The economic significance of this step is apparent from Tables III and IV and the Punjab farmers will be well-advised to take cognizance of these developments and reap the advantages which will accrue from growing these new cottons instead of the old short staple varieties.

WATER TO FIGHT FAMINE

INTERVIEWED on the possibility of sinking a large number of wells to fight the famine in the threatened areas of the South, an official of the Agriculture Department of the Central Government stated that the Government of Madras had a programme of sinking 36,000 wells during the current hot weather. In addition existing wells were to be renovated and improved. The cost of sinking a new well averaged Rs. 720 of which the cultivator was to be subsidized at the rate of Rs. 360 per well, half of the cost being met from the Central revenues. The Central Government would also bear half the subsidy of Rs. 160 per well in the case of renovation.—*Press Information Bureau,* May 1946.

BEE-KEEPING PROPAGANDA IN WEST GODAVARI DISTRICT

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THE investigations at the Agricultural Research Institute, Coimbatore, on the possibilities of rearing the Indian bee (*Apis indica*) as an economic proposition having proved a success, its development in promising districts of this Presidency was an active item of propaganda by the Department of Agriculture, Madras, during the past few years.

Pioneer work

In the West Godavari District modern bee-keeping had its beginning in the year 1935. The first attempts of the pioneers to rear the Indian bee in a Newton hive proved unsuccessful as the subject needed sound practical knowledge and not all book-learning. Later a few apiaries were started under the guidance of the Departmental staff and by the end of 1939 it was reckoned to have spread in many villages of Tanuku taluk. Thereafter the progress was rapid but the limited Departmental staff at work amidst multifarious items of propaganda could not adequately meet the growing demand of the more enthusiastic and less experienced bee-keepers of the area for help and advice in apiary management. Further a check on the faulty technique in manipulation and the use of equipment of varying standards—all due to absence of timely advice—became an immediate necessity.

To put the industry on a sound basis by providing adequate help and advice to the bee-keepers of Tanuku taluk and to examine the possibilities of extending the same to the neighbouring taluks of the district were, in main, the objects of a scheme set on foot in the year 1940. Under this scheme the whole time attention of a special staff was provided for this singular item of propaganda. The present paper embodies in brief the results of the scheme work.

Status of local bee-pasturage

A noteworthy feature of the district is the existence of a potent source of bee-pasturage by way of cultivated crops and wild flora which adequately satisfies the prime requisite for success in apiculture. The garden crops such as gingelly, *cholam* and coriander coupled with the fruit crops like mango and citrus form the main source of bee-pasturage. Added to this some of the wild flora comprising of weeds and scrub jungle in the reserve forest areas of Tadepalligudem taluk constitute a subsidiary but a potent source of the two bee foods. A study of the chief bee-pasturage crops of the area was made in general and in the table below is enlisted the important crops with their approximate periods of flowering as observed from time to time by the writer in the district.

TABLE I

Crops and their flowering periods

Common name	Botanical name	Flowering period	Yield	Remarks
Gingelly	*Sesamum indicum*	July	Nectar	First crop
		Feb.-March	„	Second crop
Coriander	*Coriandrum sativum*	Jan.-Feb.	„	Good source
Cholam	*Sorghum*	December	Pollen	Good source of pollen
Maize	*Zea mays*	August	„	„ „
Tamarind	*Tamarindus indica*	June-July	Nectar	
Neem	*Azadirichta indica*	March-April	„	
Citrus	All sp. of Citrus	January	Nectar and pollen	First flower
		July	„ „	Second flower
Mango	*Mangifera indica*	February	Nectar	Good source
Plantain	*Musa paradisiaca*	..	Nectar and pollen	Throughout the year

Demonstration and advisory work

Popularization of the industry by way of intensive propaganda constituted the main purpose of demonstration and advisory work. The following are the lines of propaganda, attempted with success, which averted all the common disabilities in propaganda. In villages where men were conservative to start the industry, trials by way of keeping Departmental hives in charge of reliable men of the village proved a success and helped much to put an end to all adverse criticisms. The incentive to trade in bee-keeping appliances like hives, extractors, etc. was slight in the initial stages but with an assurance by the Departmental staff for both the sale and profits of the business, standard equipment of dependable quality could be secured for the public at reasonable prices. Disappointments of amateur bee-keepers due to desertion of colonies resulted purely from their ignorance of apiary management and for specific reasons such as lack of food, damage from enemies like wax moth, etc. But the demonstration work, a major part of the scheme, constituted the training of the apiarists in all essential operations till self-confidence in successful apiary management was gained by them. In Table II are given the items of work attended to by the propaganda staff. This shows the steady and rapid spread of the industry in the district. Although a total number of 536 hives in 52 villages chiefly spread out in the three taluks of the district cannot be said to be the end and aim of the scheme work, the possibilities of bee-keeping to be a profitable side line to farming in the district have been established beyond doubt.

TABLE II

Bee-keeping propaganda work

Items of work	1940	1941	1942
I. *Supply of bee-keeping appliances*			
Bee-hive boxes	65	72	85
Honey extractors	12	10	8
Additional supers	5	6	8
Comb foundations	..	1 lb.	1 lb.
II. *Demonstrations*			
Hiving	56	68	67
Extraction of honey	42	53	69
Removal of queen cells	25	45	72
Control of wax moth and other pests	24	32	55
III. *Propaganda*			
Magic lantern lectures	8	10	12
Bee-keeping exhibitions	3	5	6
IV. *Spread of the industry*			
Total number of working colonies	210	396	536
Number of villages	16	38	52
Number of bee-keepers	48	80	108

Hive performance

The general condition of the apiaries of the area is satisfactory throughout the year, desertions being very few. The use of artificial comb foundation in the hives was successful but the demand for the same was not appreciable. With the exception of a few of the apiaries the honey yield level is satisfactory, and the average of the area comes to 10 lb. per hive in a year. The variation in the yield of honey between apiaries appear to be largely due to the differences in the type of pasturage in the neighbourhood and to a certain extent on the care bestowed by the owner. The performance of the hives situated in citrus and mango gardens has always been observed to be better than the rest.

Economics

As authentic record of honey yields of hives of the area were needed to evaluate the net income out of the industry, a dozen of the apiaries of the area distributed in different villages were selected and marked for the purpose of a study of the performance of the hives with specific reference to yield. The apiaries selected for the purpose varied in their hive strength from four to ten, and were under good management of the owners who were conversant with apiary technique. In Table III are given the honey yields recorded and the net profits derived therefrom by the owners. From an observation of the honey yields of the hives tabulated it is seen that the honey yield of an apiary does not bear any direct relationship to its strength. A unit of six hives which can be easily managed by an individual farmer appears to be an economic unit to reap decent profits.

TABLE III

Economics of honey production

Apiary No.	Village	No. of Hives	Honey yield lb.	Net income Rs.
1.	Khandavalli	10	110	82
2.	Vundrajavaram	6	50	35
3.	Tetali	8	80	60
4.	Satyavada	6	75	57
5.	Khaldhari	5	55	42
6.	Chagallu	8	96	80
7.	Mallavaram	4	36	29
8.	Kovvur	5	50	38
9.	Badampudi	4	40	30
10.	Venkataramangudem	5	55	40
11.	Chebrolu	6	50	38
12.	Mortha	8	90	78

Marketing of honey

The honey produced by the apiarists of the district much suffered for want of attractive prices for a long time till efforts were made by the Department to establish a marketing organization whereby confidence was created in the consuming public in respect of the purity of the stuff. The price was fixed at 14 as. per lb. The apiarists agreed to give their honey for curing and marketing it at the price fixed by the Departmental staff. It was agreed to allow a reduction of 6 per cent by weight on the green weight of honey given by the apiarists to cover losses during curing and handling of the product. The Departmental staff only accepted honey extracted under their immediate presence for sale and although the disposal of the product was not binding on their part recommended its sale to the public at the said price. This scheme of work on one hand helped the apiarists in getting their due share for their product and on the other the public at large could easily get pure honey which till then was a rarity.

Conclusions

Bee-keeping as a cottage industry proved successful in the West Godavari district as a whole excepting some portions of Narsapuram and Bhimavaram taluks. The response from both the educated classes and farmers of the district has been very encouraging. Enquiries for advice and help from the public were on the increase. An extension of special schemes of propaganda of this nature in all favourable localities would go a long way in the rapid development of the industry in this Presidency. Bee-keeping is a necessary counterpart of farming and the modern urge towards post-war reconstruction will it is hoped secure for the bee-keeping industry its rightful place in the agricultural economy of this country.

Acknowledgment

I am deeply indebted to Sri M. C. Cherian, B.A., B.Sc., D.I.C. (Lond.), Government Entomologist, Coimbatore for constructive criticism and valuable suggestions on the paper.

GOOD SEED

GOOD seed, according to the Dominion Department of Agriculture, is clean, viable, free from disease and true to a good name. When a farmer buys clean seed or cleans it himself he gets a product that is free from weed seeds, dirt and other trash. Viable seed is seed with plenty of life in it, seed that is well able to complete the process of germination. Should rain form a crust on the soil after planting, it may prevent weak seed from thrusting its tiny plant into the sunlight. But viable seed will germinate completely and get the crop off to a good start. As not all organisms attacking seed can be controlled by seed treatment, the seed for next year's planting should be disease-free. When a farmer sows a variety suited to his area he wants it to produce exactly that variety, and no other. Good seed is always true to its variety. To make sure of getting good seed, farmers may order registered seed, which is the best, or certified seed, the next best, or commercial seed.—*Dominion Department of Agriculture,* Canada.

DISEASES OF ANIMALS CAUSED BY ANAEROBES

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ANAEROBES are microscopic germs or bacteria which require for their growth complete or partial exclusion of oxygen of the atmosphere. They are widely distributed in nature, being commonly found in soil where they exist in the form of seeds or spores. They also inhabit the intestines of man and animals and often occur as putrefactive bacteria in decaying animal and vegetable matter. The spores of these germs are not easily killed by chemicals nor by the action of natural destructive agents, such as heat, sunlight and drought. Indeed, the seeds survive in nature over long periods, sometimes extending to several years. Some of these germs produce during their growth poisonous substances known as toxins which can bring about serious diseased conditions in man and animals.

Ravages caused by anaerobes

The ravages by anaerobic bacteria amongst livestock in India are known to be confined to cattle only. Diseases of sheep caused by these germs have long been known to cause heavy losses in other countries, notably England, France and Australia, but the extent to which Indian sheep are victims of these infections has not been correctly assessed; its existence, nevertheless, cannot be seriously doubted. When in the near future the sheep industry of the country will be organized and developed, proper account will naturally be taken of the losses which sheep stock is likely to suffer and it may not be unreasonable to believe that in this accounting the losses due to anaerobic infections will figure in no mean prominence.

Diseases caused by anaerobic bacteria

In view of this significance in the future development of livestock production, it will be of interest to describe briefly some of the important diseases caused by anaerobic bacteria.

Black-quarter: Black-quarter or 'blackleg' of cattle has long been known in India as a serious disease causing a large swelling on one of the quarters, followed rapidly by death. The disease occurs in the form of sporadic outbreaks, generally after the rains, although in some parts, particularly in South India, stray cases are reported to occur throughout the year. The disease is peculiarly localized in certain areas, called 'black-quarter areas', where it occurs year after year. The infection is not conveyed from one animal to another as in most contagious diseases, but the germs of the disease are picked up from the soil, where they spread from the carcases of animals that may have previously died and been left there without proper disposal. The disease is generally seen in young animals between the age of six months and three to four years, although older animals are often affected. The disease is generally caused by an anaerobe called *Clostridium chauvoei*. Black-quarter is known to occur among sheep but it is not commonly met with in this country.

Malignant Oedema: Malignant Oedema in animals is contracted when an open wound is infected with an anaerobe known as malignant oedema bacillus. This germ has a world-wide distribution, being more or less constantly present in the soil. It is also responsible for a good many cases of the disease known as 'gas gangrene' in man. The disease may affect all domesticated animals but is often seen in horses after castration, in mares after difficult labour and in sheep after shearing or other injuries.

There is an acute swelling of the affected tissues which are hot and painful and get badly discoloured with a brown frothy fluid exuding from them. The condition generally proves fatal.

Sheep Braxy: Sheep Braxy is a special form of malignant oedema affecting lambs under one year of age and is common in northern parts of Europe where it causes heavy losses to sheep breeders. Cases of this disease have been recently reported from some parts in India. In Europe the disease is generally seen in late autumn or in early winter. The germs or their seeds penetrate the bowel-wall, especially that of the fourth stomach, and consumption of frosted grass in the morning on an empty stomach appears to help them to establish in the tissues where they produce their toxin which brings about the death of the affected animals. Before death, the animals remain

sick for a few hours only and during this period they show signs of pain in the abdomen and difficulty in breathing due to the collection of gases in the bowel and at the last stage they pass into a state of coma. These symptoms are often unnoticed unless the sickness appears in the day time.

Bacillus welchii caused diseases : So far the diseases in sheep are concerned, *Bacillus welchii* group of germs is the most important of all the anaerobes. Four different types of *B. welchii* are recognized, each type being distinguished from the other by the types of toxin it produces. *B. welchii* (type A) often invades the tissues of sheep by way of wounds, occasionally causing death. The remaining three types are responsible for serious diseases described below.

(a) 'Lamb dysentery' affects young lambs in the first few days of their life. The disease is common in Great Britain and in certain other countries, where it may cause death of 20 to 30 per cent of the lambs born. The germ of the disease, commonly called lamb-dysentery bacillus (*B. welchii*, type B) gets into the system, probably through feeding of contaminated milk. The affected lambs are dull and refuse to suckle. They show signs of pain in the belly which becomes tense. There is a yellowish diarrhoea which later assumes a chocolate colour and may consist entirely of blood. Death usually takes place in about one to three days. In the chronic form of the disease, which affects comparatively older lambs, the animals may linger on for days and in some cases may recover.

(b) 'Struck' is a local name for a disease of sheep that occurs in certain parts of England due to infection with *B. welchii* (type C). The disease usually occurs in late winter or in early summer and affects year old or even older animals. The sick animals are found dull and indifferent to food. There are signs of abdominal pain and the animals usually stand with hind legs stretched out. The affected animals die after a few hours of illness. Specific toxin can be identified in the intestines of the sick animals and this is the only sure way of diagnosing the disease correctly. Death-rate among the diseased animals is very high.

(c) 'Pulpy kidney disease' is another acute and very fatal disease of unweaned lambs caused by *B. welchii* (type D) and commonly found in England, Australia, New Zealand and certain parts of America. The disease is so called on account of the peculiar pulpy condition of the kidney tissue after death. The system gets poisoned with the toxin liberated by the germ and death takes place within three to four hours after the onset of the disease. Due to this short duration the opportunities are rare to observe conditions when the affected animals are alive. The presence of large amounts of fluid in the body cavity and numerous tiny spots of blood on the surface of the heart and other organs after death are very characteristic of this disease.

Black disease : 'Black disease' of sheep occurs in Australia, where it is known to cause heavy losses. The disease is caused by yet another anaerobe, which settles in the liver tissue after the organ has been injured by young liver flukes (parasites which are found in the liver of cattle and sheep) during the act of their migration from the intestines. The liver, in the affected cases, shows on its surface, yellowish areas up to two inches in diameter. These areas actually consist of dead liver tissue resulting from the effect of the poison produced during the growth of the germs.

The disease affects adult sheep two to four years old and generally those in good condition. The symptoms of the disease are rarely noticed on account of the rapidity with which death occurs.

Prevention

The general method of protecting animals against anaerobic infections consists in the timely use of vaccines prepared from the germs responsible for the disease. The animals are injected a dose of the vaccine a short while before the outbreak of the disease is anticipated. Effects of the vaccine are sufficient to afford protection for the season. This method has been successfully used in averting serious losses amongst livestock due to anaerobic diseases in countries where they occur. The animals can also be protected with a dose of specific serum containing substances which can neutralize the effect of the poisons produced by these germs. The protection afforded by these sera, however, is only of a short duration, viz. about 10 days.

In India, where most of these anaerobic infections have not yet been recognized, it will be necessary first of all to establish definite diagnosis of the condition, whenever any of these diseases is suspected. This would result in a thorough investigation including isolation of the germs of the disease. Once the incriminating germ is isolated, it will be possible to prepare a suitable vaccine or serum to afford protection against the disease.

THE ROLE OF MINERAL MATTER IN SUGARCANE JUICE

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THE mineral matter in the sugarcane exercises a profound influence on the recovery of sugar. A high ratio of ash to non-sugars in cane juice results in low recovery in sugar in the factories. The greater the proportion of mineral matter in the juice, the more difficult it is to recover sugar in the process of manufacture. Not only does the cost of manufacture of sugar increase but great difficulty is experienced during the process of manufacture.

Preference for United Provinces gur

Prior to the imposition of the custom duty on sugar imported into India, there were a number of *gur* refineries working in the Punjab which manufactured white sugar from *gur* imported from the United Provinces. This imported *gur* was impure and of a dark colour, but it was given preference to the *gur* produced in the Punjab which was comparatively clean and more attractive in appearance. This preference for the United Provinces *gur* was mainly due to the higher yield of white sugar. The analyses of a large number of the Punjab *gur* for their sugar content did not reveal any striking difference from that imported from the United Provinces as the figures given below will show:

TABLE I

Analyses of the sugar content of the Punjab and the United Provinces gur

	Sucrose per cent	Glucose per cent	Ash per cent
Punjab			
Lyallpur	73·7	7·20	4·47
Jullundur	69·5	8·2	5·43
Amritsar	72·8	10·5	4·34
Sonepat	66·4	11·3	5·49
Gojra	71·4	7·9	6·00
Average	70·3	9·0	5·15
United Provinces			
Gorakhpur	70·3	13·5	2·8
Muzaffarnagar	74·0	11·70	2·5

It will be seen that the amount of sucrose in the Punjab *gur* is practically the same as in the *gur* from the United Provinces. The figures for glucose are decidedly lower, but the ash content is very high. Thus the main reason for the inferiority of the Punjab *gur* is apparently their high ash content which is almost double than that of the United Provinces *gur*.

A systematic study was also undertaken of the sugarcane grown in the United Provinces and the Punjab. The same varieties were selected for analysis in both the provinces. The results of the investigation are tabulated below:

TABLE II

Analysis of identical varieties of the United Provinces and the Punjab canes

Particulars	United Provinces	Punjab
Sucrose percentage on cane	10·7	10·4
Ash percentage on cane	0·314	0·504
Purity coefficient	87·0	85·9
Saline coefficient	34·1	20·6
Cane ratio	11·0	12·0
Available sugar	9·2	8·3

The most important qualitative difference between the sugarcanes of the two provinces is that the ash content in the juice from the Punjab canes is considerably higher than in the juice from the United Provinces canes. The cane ratio, or the number of tons of cane required to produce a ton of sugar, is higher in the Punjab than in the United Provinces. This ratio is a function not only of the concentration of sucrose in the juice but also of its purity, the latter being the ratio of sucrose to total solids in the juice.

Effect of manuring

Manuring tends to increase the percentage of impurities in the juice. Consequently a relatively large percentage of sugar remains unrecovered in the factory when cane is grown under heavy manuring. Although manuring results in an increased yield of canes, it tends to lower the quality of juice and it appears therefore that measures designed to increase the yield should be carefully controlled in relation to the quality of cane.

Maturity and mineral content of canes

It seems that attempts to increase the yield of cane beyond a certain limit are likely to result in deterioration of quality unless suitable varieties of canes are evolved which could maintain their quality as quantitative production is increased. It has been found that the amount of mineral matter which the cane crop is able to absorb during the growth reaches its maximum at maturity, and if the crop remains longer in the field the mineral matter either remains stationary or decreases. In other words, once the crop matures there is little likelihood of any further increase in the mineral content of the juice. Obviously in this respect early maturing canes will have an advantage over those which mature late, though their yields must naturally be low. Attempts should be made to evolve varieties which will give high yields and yet mature early. Such varieties should maintain their quality over the entire crushing period as long as they remain standing in the field.

Effect of salts on crystallization

If there is an abundance of soluble inorganic salts present in the soil, plants will absorb a larger quantity of these than is necessary for their maximum growth. It has been seen further that the nature and amount of salts taken up by the plants depend upon the composition of the soil or culture medium on which they grow. The nature of salts present in the juice exercises a great effect on the crystallization of sucrose. It has been seen that the presence of sodium salts in sugar prevents sugar from crystallizing to a large degree than calcium salts.

GUR ALLOTMENTS

ALLOTMENTS of *gur* surpluses of 4,25,000 tons during the season 1945-46, of which the United Provinces will supply nearly 300,000 tons have been made to various deficit areas in India. The chief beneficiaries are Bengal, the Central Provinces, Rajputana, the Punjab and Punjab States, and Sind, which will receive 70,000, 52,000, 60,000, 115,000 and 25,000 tons respectively as against last season's allocations of 60,000, 50,000, 65,000, 115,000 and 22,500 tons respectively.

While inter-regional movement of *gur* in the several '*gur* regions' is unrestricted, permits are necessary for exports from surplus to deficit areas. *Gur* quotas are fixed for each recipient area as well as ceiling prices.—*Press Information Bureau.*

THE CONSTITUTION OF THE LAND MANAGEMENT CIRCLE, UNITED PROVINCES

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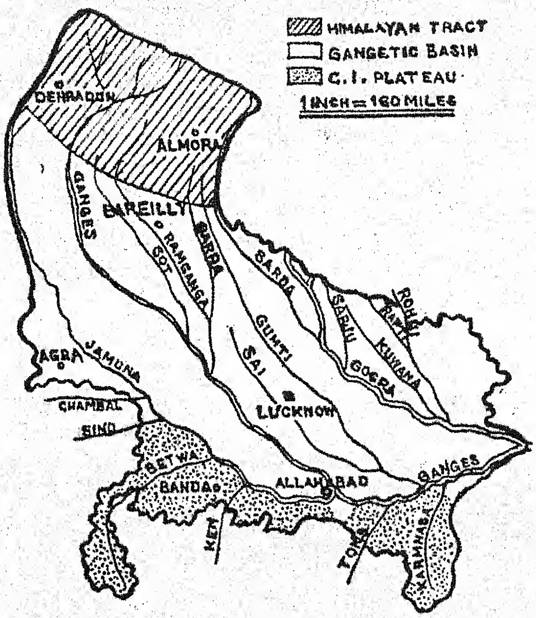
Conservator of Forests, United Provinces



THE physical features of the United Provinces suggest the following three natural divisions:

1. The Himalayan Tract
2. The Central India Plateau
3. The Gangetic Basin

The configuration of the Himalayan Tract and the Central India Plateau is not conducive to extensive cultivation. These regions are, therefore, sparsely populated and do not call for immediate attention. In the Gangetic Basin, where deep alluvium supports extensive cultivation, the pressure of ever-increasing population demands a well-balanced utilization of lands whose analysis reveals the following composition:

	Milacres*	Percentage
I. Cultivation		
(a) Under cultivation	32,140	65·7
(b) Current fallows	1,589	3·3
(c) Old fallows	313	0·6
Total	34,042	69·6
II. Habitation		
(a) Sites, buildings, etc. } (b) Communications }	1,666	3·4
(c) Grave-yards	29	..
Total	1,695	3·4
III. Waters		
(a) Rivers, streams, *nalas*		
(b) Canals, lakes, ponds	Details not available	
(c) Marshes		
Total	2,302	4·7
IV. Treelands		
(a) Groves	1,282	2·6
(b) State forests	1,106	2·3
(c) Private woods and grasslands	5,663	11·6
Total	8,051	16·5
V. Wastelands		
(a) Ravines (estimated)	500	1·0
(b) Saline soils, *usar*	1,942	4·0
(c) Sandy soils, *bhurs* (estimated)	100	0·2
(d) Bare rocks, Raukar outcrops	?	?
(e) Unclassed	272	0·6
Total	2,814	5·8
Grand Total	48,904	100

* A convenient term coined to stand for 1,000 acres. Figures given above have been corrected up to June 30, 1944.

The above classification has been adopted in preference to the one in use in the Land Records Department which mainly concerns itself with whether an area is cultivated, culturable or barren. Thus, the village records continue to regard groves, grazing grounds and treelands which have never been known to be tilled as 'culturable'. The very nomenclature adopted suggests possibilities of the extension of cultivation where none exist. Similarly, plantations along canal banks, roadside avenues, railway lands and town sites are returned year after year as 'barren'.

Maldistribution of forests

It will be seen that the proportion of systematically managed State forests is only about 2·3 per cent of the total area of this region, which, for a predominantly agricultural and tropical region like the Gangetic Basin, is dangerously low[1]. The maldistribution of these forests, which are confined, in the main, to the inhospitable tracts at the foot of the

[1] The proportion of forests in some of the European countries which enjoy a temperate climate and are comparatively less dependent on agriculture is as follows:

FIG. 1. Farmyard manure being removed as fuel

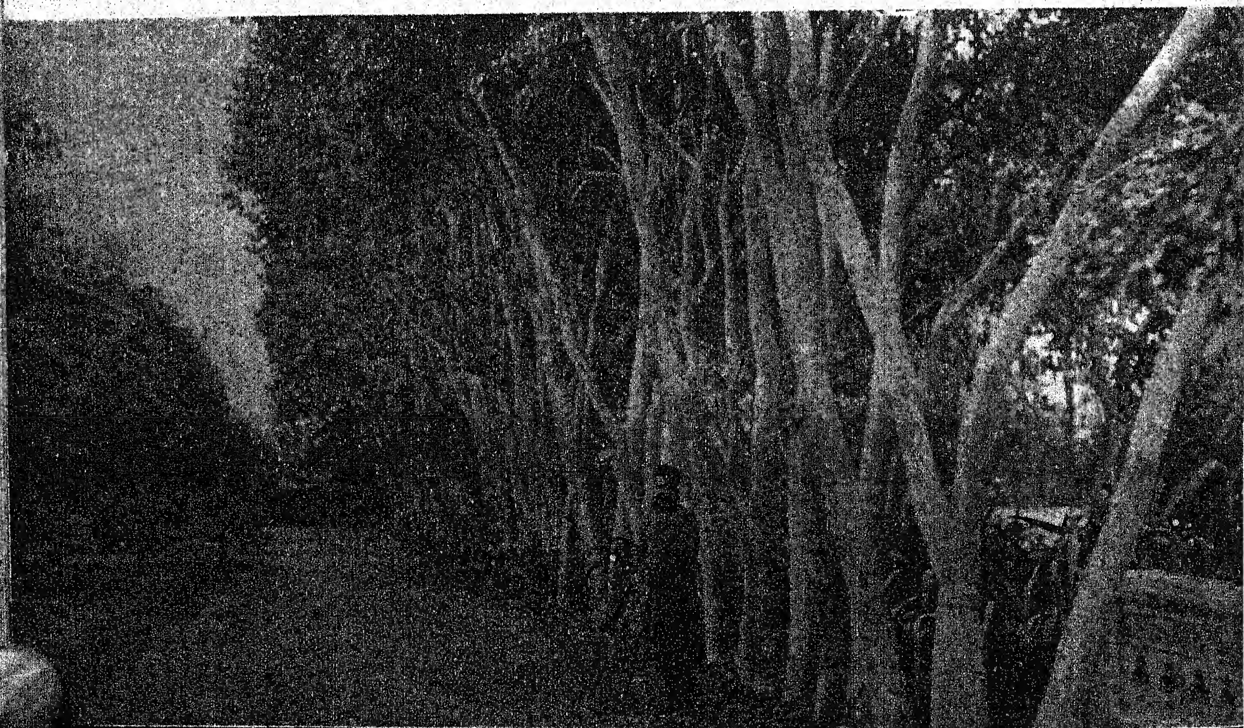
PLATE 32

FIG. 2. Dhak patches raised on *usar* (saline) soils

FIG. 1. Sissoo plantations on *bhur* (sandy) soils

PLATE 33

FIG. 2. *Jamun* furrow of a grove



Himalayas, further aggravates the situation by rendering their produce unavailable in the densely populated rural areas beyond a certain economic lead. Due to lack of firewood, the cultivator in this region is compelled to burn about half of his farmyard manure which has been estimated to amount to 50 million tons per annum. The loss occasioned by this evil practice means a sacrifice of what would virtually amount to an increase of about 15 per cent over current crop production. In a region where 70 per cent of the area is under cultivation, which incidentally is the highest record in the world, further extension of cultivation must be viewed with the gravest concern if the agronomical balance between cultivation, habitation, treelands and grazing grounds is not to be permitted to deteriorate further. The return of farmyard manure from village hearths to fields and improvement of grazing are vital factors in the rural economy of this tract. The formation of fuel and fodder reserves constitutes, therefore, an important plank of the programme of Land Management. From experience gained elsewhere, the target figure for treelands in the Gangetic Basin should be at least 25 per cent of its total area.

Fuel and fodder reserves

A review of the possibilities of the creation of village fuel and fodder reserves in various types of lands is given below.

Cultivation: Lands set apart for cultivation merit particular attention from the point of view of supplementing fuel and timber resources of this region. Now that the tenant has been given proprietary rights in trees grown on his own holding, he could do his bit by planting up a couple of *babul* trees on each acre of his holding. Being a deep-rooted species, *babul*, does not compete for nutrition in the upper layers of soil which support agricultural crops. It provides excellent fodder, fuel, tannin bark and timber. Above all, its attenuated leaf-surface does not shade crops as other species do. Pruning of branches to a height equivalent to the radius of the crown and reduction of leaf-surface to provide fodder for cattle further reduce shade. To compel the cultivator to set apart a portion of his land for fuel and fodder production is to attempt the impossible. It is easier for him to learn to face the sacrifice involved, if any, in the shading of his crops by widely scattered *babul* trees on his holding. An average of two trees per acre would mean 68 million trees on the land ear-marked for cultivation or the equivalent of two million acres of *babul* plantations with 34 trees to an acre. An area which corresponds to the pattern described above has been under observation for some years in the Bareilly District. The fact that this idea caught on and spread during the last 15 years is proof positive of its having carried conviction to the hardest of all practical realists, viz. the cultivator. Before giving effect to this proposal on a large scale it is proposed to test it further in collaboration with the Department of Agriculture.

	Percentage of total land area		Percentage of total land area
Finland	74	Norway	21
Sweden	55	Italy	20
Russia (European)	44	Greece	19
Austria	38	France	19
Czechoslovakia	34	Belgium	18
Latvia	27	Spain	14
German (Reich)	24	Hungary	13
Roumania	24	Denmark	9
Switzerland	23	Netherlands	8
Poland	23	Great Britain	6
Portugal	22	Gangetic Basin	2

Habitation: Lands grouped under this head provide ideal opportunities for planting trees. Roadside avenues and railwaylands, account for an area amounting to about 290 milacres which could be planted up with fruit, timber and fuel trees. Similar opportunities exist on village sites, threshing floors, camping grounds, compounds of public buildings and *nazul* lands.

Waters: Canal banks at present classed as 'under water' will provide plantations, equivalent to 75 milacres.

Treelands: Of these, groves which have been hacked about during the war need renovation. Private woodlands similarly need rehabilitation.

Wastelands: Ravines along the banks of the Jumna, the Gomti, the Sai and lesser streams account for half a million acres of land where adoption of protective measures to prevent erosion would yield tangible dividends. Saline soils (*usar*) account for two million acres which can be made to yield a fair amount of grazing by a simple rotational closure to cattle during the rains. Milder types of *usar* support scattered tree-growth where roots can negotiate the *kanker* pans below. Better types of *bhur* soils have already responded to attempts made at afforesting them in the Rohilkhand Division.

Activities of the Forest Department

The Forest Department, which was constituted in these provinces in the early sixties of the last century for the management of State forests, has concerned itself, in addition to its normal duties, with various aspects of the problems outlined above and a lot of valuable information has been collected during the last 75 years. Attention first came to be focused on the reclamation of the Jumna ravines in 1912 when the Afforestation Division was formed to control the erosion along the banks of the Jumna. The next 25 years witnessed systematic research on the treatment of various types of wastelands such as *bhurs* (sandy soils) and *usar* (saline soils). In 1938, a Forest Development Division was formed which has been largely responsible for the creation of fuel and fodder reserves on private wastelands of various types and reclamation of denuded lands.

Land management circle

The creation of the Land Management Circle in the Forest Department, United Provinces on November 1, 1945 represents the natural sequel to the ever-increasing activities of the Afforestation and Development Divisions. The Circle, constituted as at present, comprises the following 4 divisions :

Divisions	Headquarters	Districts	Area in sq. miles
1. Northern Doab	Meerut	1. Saharanpur 2. Meerut 3. Bulandshahr 4. Aligarh 5. Muzaffarnagar 6. Muttra 7. Agra	13,276
2. Southern Doab	Etawah	1. Etah 2. Farrukhabad 3. Mainpuri 4. Etawah 5. Cawnpore 6. Jalaun 7. Fatehpur	12,293
3. Rohilkhand	Bareilly	1. Bareilly 2. Bijnor 3. Budaun 4. Moradabad 5. Shahjahanpur 6. Pilibhit	10,865
4. Oudh	Lucknow	1. Sitapur 2. Lucknow 3. Unao 4. Rae Bareli 5. Partabgarh 6. Sultanpur 7. Fyzabad 8. Bara Banki	13,298
	Total	28 districts	49,732

The existing Afforestation and Forest Development Divisions have been absorbed in the organization outlined above which covers an area of about 50,000 sq. miles out of a total area of 106,247 sq. miles.

Proposed extension of activities

Apart from tendering expert advice to private owners in the rehabilitation of their woodlands it is proposed to acquire about a million acres for purposes of the creation of village fuel and fodder reserves in the next 10 years. The activities of the Circle for the next 5 years will include :

1. Afforestation of State lands such as :
   - (a) Canal banks
   - (b) Roadside avenues
   - (c) Camping grounds

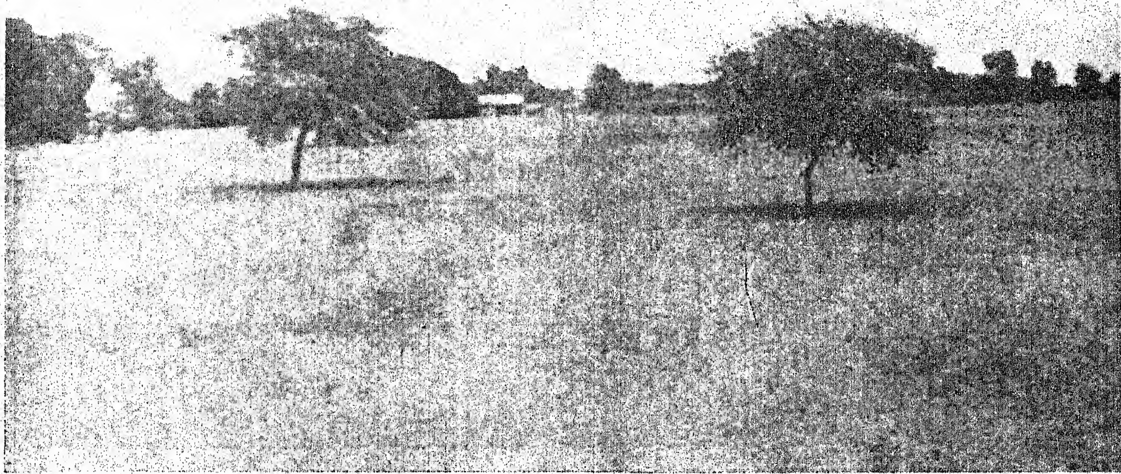


Fig. 1. *Babul* growing on cultivated lands

PLATE 34

Fig. 2. Land laid waste by the Gomti

(d) Compounds of public buildings
(e) Railway lands
(f) Acquired lands
(g) Nazul lands
(h) Lands belonging to public bodies such as Improvement Trusts, Municipalities, etc.

2. Creation of small village plantations in all districts where tree-growth is at present deficient.

3. Control of erosion, reclamation of ravines and other denuded areas.

4. Utilization of *usar* (saline) and *bhur* (sandy) soils.

5. Tendering advice on the management of:

(a) Court of Wards lands
(b) Lands belonging to zemindars and tenants
(c) Groves.

KING'S BIRTH-DAY HONOURS

THE King's Birth-day Honours List includes several names connected with services to agriculture and animal husbandry:

To be Knight Commander of the Order of the Star of India

THE HONOURABLE SARDAR SIR JOGENDRA SINGH, Member of the Governor General's Executive Council.

To be Companion of the Order of the Indian Empire

CAPTAIN ULRIC WILLIAM FARRIER-WALKER, M.R.C.V.S., M.C., Indian Veterinary Service, Director, Veterinary Department, Punjab.

To be Officers of the Order of the British Empire

JOHN MCINTYRE, ESQ., Deputy Agricultural Production Adviser (Manuring) to the Government of India.

HEM SINGH PRUTHI, ESQ., Ph.D., Plant Protection Adviser to the Government of India, and Director, Locust Control, India.

To be Member of the Order of the British Empire

RAM LAL KAURA, ESQ., M.R.C.V.S., Central Veterinary Service, Deputy Director of Veterinary Services, Orissa.

Sardar Bahadur

SARDAR SAHIB SARDAR UDAM SINGH, Deputy Director of Livestock Production, Meerut Circle, United Provinces.

Rai Bahadur

RAI SAHIB SUDHIR CHANDRA SARKAR, B.A., Under Secretary, Imperial Council of Agricultural Research, New Delhi.

Rao Bahadur

PADMANABHAN SIVASANKARAN NAIR, ESQ., Deputy Director of Veterinary Services (Officiating), Central Provinces and Berar.

Khan Sahib

JAFFERALLY RAHMATALLAH BANA, ESQ., Veterinary Inspector, Lower Sind Circle, Karachi, Sind.

Rai Sahib

SULTAN SINGH, ESQ., Deputy Director of Agriculture, Rohilkhand and Kumaon Circle, Bareilly, United Provinces.

RAM KRISHANA RAM, ESQ., Assistant Director, Civil Veterinary Department, Patna, Bihar.

Rao Sahib

DR. RAMCHANDRA JAIKRISHNA KALAMKAR, B.Sc., B.Ag., Ph.D. (London), F.A.Sc., Deputy Director of Agriculture, Central Provinces and Berar.

A NOTE ON THE INTRODUCTION OF *ROHU* AND *MRIGAL* INTO MADRAS WATERS

N. JAGANNATHAM
Fisheries Training Assistant, Madras

THE following note was written at the request of Dr S. L. Hora, Director of Fisheries, Bengal, so that it may be of use to pisciculturists of all provinces engaged in transporting larvae and fry of carps over long distances. Inland pisciculture is now engaging the attention of the Government of all provinces and States and inter-provincial transport of valuable fishes is obtaining on a commercial scale. This successful experiment is the first of its kind and it is hoped that the details of *modus operandi* might be of some use to other workers in the line.

Introduction to Madras

On taking charge in the Madras Fisheries as Assistant Director (Freshwater Research) and with his previous experience with the important upper Indian carps, Dr T. J. Job proposed their introduction to the Madras province from Bengal with a view to enriching the quality of its fresh-water fisheries. The Government of Madras accepted the proposal and ordered to transport a trial consignment of 250 fingerlings each of *rohu* and *mrigal* to Madras. Dr Hora was requested by the Madras Fisheries to help them in procuring fingerlings of these two species and he promised all help to the Departmental man deputed for their transport. Dr Hora indicated that the most suitable period for obtaining selected variety of *rohu* and *mrigal* fingerlings would be the months of August and September. He also suggested that though very young fry were already available on June 8, 1943, in the market, it was difficult to distinguish them at that stage and that it would be possible to make a good selection in another four or five weeks. Fingerlings of 1½ to 2 in. in size appeared in the Calcutta markets by about 20 August, 1943, and a Fieldman was deputed to Calcutta on September 7, 1943.

Unwholesome factors

On arrival in Calcutta, the fieldman found no facilities for conditioning the fish in the way it is done in the Madras Fisheries Department. Conditioning boxes and freshwater ponds suitable for conditioning fish were not available at site. The water in many of the tanks used as nurseries in the unsewered part of the town was contaminated by the city drain and the fish were collected by drag netting. General inclement weather, spasmodic showers and the muddy nature of the beds of conditioning ponds also added to the list of unwholesome factors in the treatment of fish. In the absence of conditioning boxes, the fieldman had to devise *darma*-cages and subsequently use some cement tanks for trial conditioning. The experiments were not successful for obvious reasons. Within Bengal, fish fry are transported over short distances without previous conditioning. The Department of Fisheries, Bengal, made some arrangements with the Bengal Nagpur Railway for transporting fry from Calcutta to Madras. But due to abnormal situation and lack of railway space, the railway authorities could not arrange a special van for the fry and it was unfortunate that the space for the live fish was allotted in a closed luggage van in spite of all efforts to persuade the staff at the station to accommodate them in a more healthy situation. The jolting in the train, especially in the last compartment, was too severe for these fingerlings and consequently there was very high mortality in the consignment. This experiment proved a failure for the reasons stated above.

The lessons of the first experiment, however, proved very valuable. The Inland Fishery Development Board, Madras, accepted the suggestion of Dr Hora to transport a second consignment, but only of larvae and fry and not fingerlings. He laid special stress on transporting small quantities of very young stages of these carps so that they might be carried along with the attendant in his own compartment. On this occasion the experiment was to be conducted by an assistant inspector assisted by a fieldman. A fieldman and myself were selected for the purpose and we left Madras on July 7, 1944.

The backwater perch

As previously arranged by Dr Hora, a small consignment of the backwater perch, *Etroplus suratensis*, and the Java fish, *Osphromenus gourami* was taken by us for introduction in the Bengal waters.

Two dozen *gourami* and four dozen *Etroplus* were ordered to be taken. *Gourami* were brought from Satyavedu Pond and released in the round pond of the Chetput Farm on June 17, 1944. These were caught on July 2, 1944 and two dozens of them were put in two glass aquaria of the Freshwater Research Station. Three dozen fingerlings (3 to 4 in.) of *gourami* and a dozen adults (6 to 8 in.) of *Etroplus* were netted from the Chetput Farm and conditioned for about 20 hours till the noon of July 3, 1944. It was an experiment in long distance transport of adolescent *gourami* and adult *Etroplus*. Small-sized, round tin carriers were insulated with straw rope and then covered with woollen covers to facilitate proper control of temperature. In the above manner I had successfully transported adolescent *gourami* from Satyavedu to Madras during a hot day in June (June 17, 1944) and the result achieved encouraged me to repeat the experiment. On this occasion one dozen each of *gourami* and *Etroplus* were taken in three tins and the remaining three dozens of *Etroplus* were put in the fourth. For transporting these tins in the same compartment as the attendant, the M.S.M. Railway authorities, who were approached in the matter, expressed their inability to make any special arrangements. The fish tin carriers were, therefore, placed in a corner in the luggage van.

Long distance transport

The Assistant Director (Freshwater Research), Madras, had issued the following instructions regarding changing water *en route*. 'Drain out the bottom-most 1/3 of water containing the sediment and the faeces of the fish which are responsible for the depletion of oxygen-content and enhancement of carbon-dioxide which result in the fall of *p*H. This is to be achieved not by the usual tilting of the tin carrier and draining off its contents which only let off the top layer which is in no way deleterious to the fish, but by syphoning out the former by means of a rubber hose pipe'. While doing this, the attendant has generally to use a torch-light to spot the exact positions where the sediment and excreta are accumulated. While switching on the torch, care should be taken that sudden light does not fall into the tin as otherwise the fish react to the stimulus, and dash against the sides of the can in their attempt to rush into darkness and thereby cause injuries to their mouths, fins and scales. Prevention of injury to the fish is the most important factor especially in long distance transport. By this method the disturbance to the fish will also be minimized as the tin carriers are not shifted from their position. The usual method of changing cool freshwater at every 100 miles or 4 to 6 hours' interval was strictly followed. In the intermediate halts, attention was paid to the maintenance of temperature and the oxygen content; this was achieved by pouring the water of the carrier back into it from a height with the lid intact. We had sufficient quantity of ice with us but we had no occasion to use it, even during the hottest part of the days since the straw insulation had served the purpose of maintaining the required temperature. There were no casualties during transport. But one *Etroplus* fingerling, which had evidently been injured during capture and conditioning at Chetput, developed a sore on its side by the second day of the transport (July 4, 1944). Lest this sore should be attacked by fungi, which might infect the other fish, it was removed and thrown out. The consignment was planted in a tank of the Bidyadhari Spill *Matsyajibi Samabaya Samiti* (Fisherman's Cooperative Society). The tank was later inspected by us along with the Director of Fisheries and the District Fishery Officer. Necessary instructions were given on the care of the fish and the improvements of tanks. The importance of these fish from Madras for acclimatizing in Bengal waters has been reported in the *Bengal Weekly* dated September 4, 1944. The secret of success was nothing but constant attention throughout day and night during the journey. This experiment enabled us to understand the critical situations and practical problems arising unforeseen during long distance transport and to devise preventive or remedial measures for bringing down *rohu* and *mrigal* to Madras.

Technique of transport

I interviewed Dr H. K. Mukerjee, Professor of Zoology, Calcutta University, who has been engaged in the study of the life histories of the Bengal carps and received from him some instructions on the characteristics

and the identification of fry of the important species, viz. *rohu* and *mrigal*. His research and laboratory assistants were kind enough to show me round their museum and aquarium, especially the preserved early stages from egg to adult of the important fishes. This helped a great deal in my tours in Rajshahi and Midnapore districts to study the collection and transport of carp larvae and spawn in the river Padma and *bundh*-type of tanks respectively. We accompanied a consignment of carp larvae from Rajshahi to Calcutta in train studying the technique of treating the larvae during transport. By paying repeated visits to the Calcutta fish 'spawn' markets, all the details of this process were studied. After a personal representation made to the Chief Traffic Manager, Bengal Nagpur Railway, permission was granted for taking only four *hundies* of fry and larvae in the second class compartment and so more fry could not be transported. This deficit had to be made up by transporting fry in tin carriers in the usual closed luggage van. Under the guidance of Dr Hora, small laboratory experiments were conducted on one inch carp fry in rectangular glass aquaria. The fry showed signs of proper conditioning and even healthy growth in the aquaria and thereby showed that they could be transported (without the Madras method of conditioning adopted for fingerlings in the specially designed boxes of wooden bottom and wire gauge sides and top). The utility of this measure had the greatest effect on the transport experiment since otherwise the fish could not be conditioned at all on approved scientific lines for want of proper facilities in Calcutta, though I was properly equipped with a collapsible conditioning box for the purpose. The question of conditioning having been eliminated, I received the stock of fry of one inch and two inches on the morning of the day I left Calcutta (July 25, 1944). The fish merchant, in spite of his undertaking to supply one inch fry, could not do so as he had not the required stock with him. I had to take fry about two inches since I could not arrange with another supplier nor could I alter the date of my starting since the reservation of space both for luggage and passengers had been fixed once for all. As is not uncommon in Calcutta, the stock pond of this fry was super-manured with drain water and was emanating a foul stink and a great problem arose at this juncture for the following reasons:

1. Two inch fry normally requires at least a day's conditioning. But there were no facilities for this in the above pond.

2. Transporting in this obnoxious water was both undesirable and impracticable, since the attendant could not stand the stink which almost resembled that of septic tanks.

3. There was lack of sufficient interval between collection and transport at least to bring the quality of the water to the required freshness. However, sticking to the principle of commencing the transport with the same water as in the pond, we packed the fish in the same foul water. This is the first time I had the experience of fish transport with two abnormal factors let into the experiment, viz. transporting fry of two inches without conditioning and (2) using foul water as medium in the tin carriers.

4. This Calcutta water was not changed till Kharagpur, a distance of 72 miles from Howrah, as it was felt that acclimatization of limited space in tins should have precedence over change of water.

Casualty during transport

We started with about 100 fingerlings in each of the eight tin carriers and 250 in each of the two earthen *hundies* and about 30,000 larvae accommodated into two earthen *hundies*. All the four *hundies* were kept in the second class compartment. The one inch fry in earthen *hundies* did not suffer any casualty from start to finish of the transport; 12 fingerlings had, however, died between the pond and Howrah station. About three dozens died between Howrah and Kharagpur. This is the longest and the speediest run on the line between Calcutta and Waltair. The jolting was the maximum and so also the casualties. When the first phase of the risk was over, we gained confidence and began to change water by slow degrees, viz. by about a mug in each tin at a time. Thus it took the whole night for changing the water to bring it to the normal freshness. Muddy and brackish water was scrupulously avoided throughout. Two extraordinary factors disturbed us during the first night, viz. fall of temperature and the fall of pH which were attributable to the following respective reasons:

1. The extra insulation with hay-rope.

2. Decomposition of the organisms in the foul water from the ponds combined with the liberated carbon-dioxide by the fishes.

These were overcome by (1) removing the woollen covers and allowing the wet hay-rope

to dry up and (2) by agitating the water and aerating it; change of water in large quantities, though seemingly advisable, could not be ventured lest the fish should suffer from the sudden changes of temperatures. During the night some fish were chilled by the fall in temperature and began to float belly upwards apparently in suspended animation but when thrown out on the floor of the compartment began to wriggle, possibly absorbing warmth. If this had not been fortunately noticed in time more live fish would have been cast aside presuming them to be dead. This hint was communicated to all the departmental officers who came to receive consignments at Vizagapatam, Bezwada and Nellore. The ordinary method of preventing the fall of temperature is to pour water on the woollen covers but in the circumstances, this too could not be resorted to lest the temperature of the water should rise up and remain at that level for a longer time than is required. Two tin carriers and one *hundy* of larvae were released at Vizagapatam to the charge of the Sub-Inspector deputed for the purpose of stocking in the Municipal tank near the District Superintendent's Office. By the time we arrived at Vizagapatam, death of another two dozens had occurred. Between Vizagapatam and Godavari no deaths occurred. But as night advanced, the temperature again began to fall down (though not the pH as the water was almost fresh) and 20 fish died before the train arrived at Bezwada. Another two tins were handed over to Inspector of Fisheries, Kurnool, at Bezwada, for rearing in the Sunkesula Fish Farm[1] with instructions to thoroughly change the water with that of the river Kistna. Similarly the remaining tins were thoroughly changed with tap water in which the Ganges mud brought from Calcutta was dissolved. The principle involved in this mud solution is to render water more alkaline which will get only neutralized by the carbon-dioxide liberated by the fish. This tip has been obtained from the Calcutta fish traders who adopt this method in their transport of larvae. The scientific principle involved was explained to me by Dr Hora. This elaborate process could not be conducted in the brake van as the time of halt was neither sufficient for the purpose nor did the guard allow us to stay in the brake van when the train was in motion. Here again arose a serious problem as in these circumstances, the casualties would have mounted up in the lowered temperature of the water in the cans and the exhausted condition of the fry caused by about 1½ days railway journey.

[1] At the time of writing this note it is understood that the Bengal carps stocked in the Sunkesula Fish Farm on July 27, 1944 have grown up to 7 in. in length by October 23, 1944.

I was forced to take charge of the cans from the brake van and put them all in the second class compartment and the entire quantity of water had to be changed to stop further mortality. Fortunately, the fish got water of the required colour, taste and temperature similar to the one which is used for the *Catla* stocking operations in Madras. This deliberate and final measure had prevented further mortality and the tin cans were retransferred to the brake van at Bitragunta. One tin carrier of fry and the remaining earthen *hundy* of larvae were handed over to the Assistant Inspector, Ippur at Nellore, for rearing in the Ippur Fish Farm. The next and the last change of water was carried out in Sullurpet and fish arrived at Madras Central and thence to Chetput Fish Farm safe. A small consignment of 25 fry were released into the newly formed Poondi Reservoir.

Tending the larvae

The process of tending the larvae in transport is briefly as follows:

About 30,000 larvae were taken in two full-sized *hundies* containing Hooghly waters wherein sandalwood-paste-like highly alkaline alluvial mud of the Ganges had been dissolved to the required consistency which was determined by experience. A surplus quantity of mud was put at the bottom of the *hundy* mainly to act as a corrective to the liberated carbon-dioxide. As this foul gaseous content accumulated more and more at the bottom and as the process of neutralization was delayed there was a tendency for the fish larvae to rise to the surface. This phenomenon was considered generally undesirable and was totally detrimental to the larvae, especially as the tiny larvae ran the risk of getting matted up together because the number, 1,000, was abnormally out of proportion to the surface area in the *hundy*. Now, what the attendant did was that (i) he eliminated the carbon-dioxide at the bottom and (ii) he prevented the larvae from rising to the top. Though the bottom sediment (mud) helped this process it was too slow in its action.

The second object was achieved by (a) hand-paddling and agitating the superficial layers of the waters in the *hundies* which scared the

fish larvae to the bottom and also oxygenated the upper layer and (b) sprinkling few drops of concentrated solution of the Ganges mud on the water surface in the pots. Oxygenation by inflated automobile tube arrangement described by Dr Mukerjee was done wherever the train stopped for short time, the longer halts of the train being utilized for changing the water. This was the most exacting but none-the-less interesting part of the whole experiment. The containers as well as the contained were the last words in delicacy. A breakage of the *hundy* destroys the whole experiment and it might occur any moment and the death of a single larva might destroy many others in a short time, especially in view of the fact that organic putrefaction sets in very early in the embryonic stages. In spite of the best attention, larvae do die, but in this particular case the mortality was very low and negligible as compared to the millions of larvae that die at the hands of expert professional fishermen as I have noticed from Rajshahi to Sealdah. I am thankful for the very practical tips given by Mr. B. N. Das Gupta, District Fishery Officer, Calcutta, who is an authority on this process, having handled fry transport both in trains, *hundies* and head loads and has perfected the methods of oxygenation in collaboration with Professor Mukerjee. The larvae were transported successfully and the first *hundy* was released at Vizagapatam and second at Nellore, and the others further South.

Acknowledgments

I am thankful to the Government of Madras for having kindly granted me better travelling facilities and to the authorities of the Bengal Nagpur Railway for allowing transport facilities of live fish larvae.

I am much indebted to Rai Bahadur Dr S. L. Hora, Director of Fisheries, Bengal, for facilities, help and guidance and also to Messrs. K. N. Das, B. N. Das Gupta and S. R. Muzumdar, District Fishery Officers, Bengal, for giving me the necessary field training.

I am specially grateful to Dr H. K. Mukerjee and the staff of the Zoology Department, Calcutta University, for instructions in the identification of carp fry in the several stages of their development.

Thanks are also due to Janab Yacoob Sahib, the field assistant who accompanied me and to the Director of Industries and Commerce, Madras, for kindly according permission for the publication of this note.

MAXIMUM AMOUNT OF FOOD TO INDIA FROM AUSTRALIA

AUSTRALIA is making every effort to ship a maximum amount of food to India as quickly as possible. Australia, in collaboration with the Combined Food Board and the British Food Ministry, will this year export a million tons of food, of which India will get a considerable share. The Minister for Agriculture and Commerce, Mr. W. J. Scully has stated that Australia will make available in the first half of this year every ounce of wheat and flour that can be exported to India and other countries in urgent need. Mr. Scully has ordered that in addition to supplies from other sources, between five and ten million bushels from a reserve set aside for specific purposes would be devoted to relieve Indian shortage. Flour mills are working three shifts daily and Australians have been told that there will be no rice for civilian consumption for an indefinite period, as the whole Australian rice crop is to be exported. Australia's Government-sponsored vegetable dehydrators, which were set up as a war-time measure, have been kept in operation, so that dehydrated potatoes and other vegetables can be shipped to famine areas of India and elsewhere.—*Austral News*, May 1946.

COTTON GROWING ON COLLECTIVE FARMS IN RUSSIA

Lt. Col. E. Noel

Hamidiah Farm, Paiforce

MANY competent authorities are of the opinion that the real hope for Indian agriculture is in some form of collective farming. Suggestions have been made that a commission from India should go to Russia to study the working of the collective farms. It is, therefore, not without interest to examine a concrete example of the agronomic technique of the collective farms. This is to some extent facilitated by the voluminous literature which the Agricultural Department in Russia publishes. Cotton will be considered as it is of importance to India.

Since the revolution, Russia has greatly developed the cultivation of cotton in Russian Central Asia. Her Agricultural Department has published a handbook entitled '*How to Obtain High Yields of Cotton*'. It is written in a simple language as it is intended primarily for the guidance of workers on collective farms. A feature is the prominence given to the leaders of the collective farms which have produced the best results. Their photographs are published and there are frequent references in the press to their methods and their successes. The record which is held by a collective farm is 162 md. per acre of seed cotton (15·1 tons per hectare) is of course exceptional, but yields of 10 tons per hectare (108 md. per acre) are frequent. Those reaching such yields are rewarded with the title of 'Stostentnerovik' which translated means a 'ten tonner'. This system of 'social competition' is an important factor in raising the productivity of labour.

The following is a resume of the instructions given for obtaining high yields:

The autumn ploughing should be to a depth of 10 to 12 in. Two irrigations are given in the winter, one to supply the necessary moisture to the soil and the other to wash out the salt. If there is drainage, this latter irrigation can be from 6 in. upto 16 in., depending on the amount of salt present. If there is no drainage the delta should not exceed 8 in. This washing out of the salt is essential if full benefit is required of the manure applied.

At the end of the winter the land is cultivated with chiseler and this is followed by a ploughing to a depth of 8 in. The final seed bed is prepared by harrow. The signs of a good seed bed are that no clods should have a diameter of more than 2 in. and that three-quarters of the clods should be of less than half an inch in diameter.

The seed should be carefully sorted and cleaned, treated with formalin, and steeped in running water for 24 to 30 hours, but only for 16 to 18 hours if the water is cold. The sowing is done by drill in lines 30 in. apart. The seed rate is 110 kg. per hectare (48 seers per acre). As soon as the seedlings have appeared the first thinning is made by cross cultivating the land to leave 8 in. strips of seedlings with 20 in. between them. Each strip is then thinned by hand so that 5 or 6 seedlings are left. When the seedlings have made two or three permanent leaves a second cross cultivation is made and a final thinning to three to five plants per clump. If in any clump (strip) the number of plants is deficient, either additional seeds are sown or seedlings from other clumps are transplanted. By varying the number of plants per clump the population per acre can be anything from 8,000 to 40,000. For good land a population of 25,000 to 30,000 is recommended which may go up to 40,000 for poor land.

It is recommended that there should be at least six weedings and the same number of cultivations which should go to a depth of 6 to 8 in. The first cultivation and weeding should be done as soon as the seedlings have appeared.

Manuring

This of course depends on local conditions. A typical treatment for average soil is 360 lb. of nitrogen, 360 of phosphorus and 90 of potassium per acre. The proportion should be two of artificials to one of organic. The manure should be applied in three stages. When the land is ploughed in the spring the farmyard manure is applied. The first dose of artificials are given when the buds are forming and the second when the plants are flowering. Stress is laid on getting the manure down to a depth of 8 to 12 in. With this object irrigation should be given after manuring.

Irrigation

Reference has already been made to the winter irrigations to impart the necessary moisture to the soil and to wash away the salts. The number of additional waterings must of course depend on local conditions. The number may vary from 5 to 12. An average practice is two waterings upto flowering, 4 to 5 during the period of flowering and 1 to 2 while ripening. The periods between the waterings may be 10, 20 and 17 days respectively. The deltas are 3, 4 and 3 in. respectively. Irrigation is by furrow. By cross cultivation these furrows are destroyed and it is therefore necessary to remake them by ridging plough.

Pruning

When the plant has 8 to 10 boll-bearing branches, the tops of the side branches which are not bearing bolls, are pinched off. This is followed by pinching off the tops of the leaders. This pruning starts in the beginning of July. Pruning increases the yield from 20 to 25½.

Harvesting

Cotton pickers usually use one hand. They should be trained to use both at the same time. They can learn to do this after a week's practice. When the flush of bolls is full, the normal for a day's work is 45 kg. By the same methods of social competition already referred to a record of 541 kg. has been achieved. The pickers should stick for the whole time to picking. A hand should be detailed to carry the cotton of each picker to the collection centre.

Yield

Each plant should bear an average of 15 bolls weighing 7 gm. The yield with a population of 30,000 will thus be 3·15 tons per acre.

Transplanting

In Russian Central Asia, Egyptian long staple cotton does not open its bolls in time. Cotton is therefore sown in a hot bed in March and transplanting is done in April. Four seeds are sown in cylindrical containers 2 in. in diameter and 5 in. in length, made of newspaper in two layers. These containers are packed in wooden boxes which are placed in the hot bed and covered with glass. The space required for transplanting an acre is 50 sq. ft. The plants (three to a clump) are set out in lines 3 ft. apart and with 21 in. between the clumps. The labour required per acre is as follows:

TABLE I

Labour required in transplanting cotton plants

	Men days	Women days	Children days	Horse days
Preparation of hot bed	8	..	..	½
Carriage manure to hot bed	2	..	..	2
Making paper containers	..	12	4	..
Sowing seeds in containers	..	2	..	..
Transplanting	3	12	7	..
	13	26	11	2½

Pests and diseases

It is stressed that prevention is better than cure. The preventative measures quoted are getting rid of the cotton stalks of the previous crop and also of weeds and other vegetation that might serve as hosts, treating seed with formalin against gummosis, destroying any part of the cotton plant as soon as it becomes infected, keeping down the weeds by summer cultivation and thereby lessening the danger of attack, guarding against root-rot by deep cultivation. To stop the ingress of *Epitetrahigchus altheae* a belt of plants on the borders of the cultivation are dusted with flowers of sulphur. In case these prophylactic measures fail or are only partly successful detailed instructions are given for combating the various diseases and pests.

PLANT BREEDING—A SOLUTION FOR FOOD SCARCITY

Rao Bahadur Sir T. S. Venkatraman, Kt., C.I.E., D.Sc.
Retired Government of India Sugarcane Expert, Madras

FOR a variety of reasons—some of them beyond human control—the food scarcity in our country has recently assumed a critical and tragic position. Briefly stated, the present condition has resulted from various causes such as a wrong agricultural and developmental policy, an export procedure not always conducive to our best interests, and increase in population not even partially covered by increase in agricultural production. If some radical alterations in policy, and methods are not adopted, food scarcity in our country is bound to steadily worsen in the future.

Among others plant-breeding offers one major method for solving the problem. The peculiar circumstances relating to crop production in our country necessitate an orientation in the methods that are generally adopted in this branch of agriculture all over the world. One of the major difficulties in ensuring a uniform level of crop production in the country is the uncertainty caused by vagaries of the monsoons both in time and quantity of resulting rains. In its turn, this factor besides affecting rain-fed crop lands, has a bearing on the availability or otherwise of irrigation waters both in quantity and in time. This indicates one important characteristic of the new kinds which the plant-breeder in India has to produce, viz. the breeding, by all the technical means at his command, varieties and strains that could stand fairly well the uncertainties in the matter of irrigation and water needs. A second difficulty of equal value in crop production is the poverty and the below-average equipment that the average agriculturist in the country is able to command. To him a variety which gives fair yields under average cultivation conditions is more useful than another which needs an expensive improvement in cultivation methods for yielding results. When one hears of the comparatively slow spread of certain recommended varieties it will often be found that the reason is the comparatively higher type of cultivation which the variety needs but which is beyond the means of the grower. It is true that for putting up the yields of Indian crops at their highest there should be brought into being a suitable combination of better varieties and better methods of cultivation. But till the conditions of the cultivator improve enormously—and this is yet far off—an increase in yield without much increase in cultivation expenses might well be the immediate aim of our plant-breeders. One method by which the plant-breeder in India could secure both the above-mentioned objects, viz. (1) ability to withstand deficiency, irregularity or uncertainty in water needs and (2) ability to give useful results under average cultivation conditions, is the employment of the wild progenitors of his crops or of plants allied to them, as parents in his breeding work. That the above is a practical proposition of proven utility is endorsed by the results obtained from sugarcane breeding within the last two decades. It has been conceded by competent authorities that in the matter of the rapid spread of improved types in cultivation, the new sugarcane strains are easily at the fore-front; in parts of the country over 90 per cent of the area has been conquered by these types and this within almost a decade and a half.

The average cultivator in India has often been blamed for his supposed conservatism in adopting new improvements. A careful comparison will show that he is not by any means more conservative than his class in the other parts of the world. While it is true that long privations and uncertainties resulting from the vagaries of the monsoons have made the Indian farmer somewhat wary in adopting innovations, he is second to none when an improvement can be proved to his satisfaction and in his own field. More than one sugarcane now popular in the country was re-discovered by the neighbouring cultivator sometimes after its rejection by an organized experimental station working in the area.

Both in Soviet Russia and the U.S.A., there are organizations for the collection from time to time of the wild proto-types of their cultivated crops from all over the globe; the ultimate object in such collections is to utilize them directly or indirectly in their plant breeding operations. Based on the success that has resulted from the employment of the wild types in sugarcane breeding, the Indian Central

Sugarcane Committee is shortly to organize a thorough exploration of our country for the collection and study of the wild sugarcanes. There is little doubt that equally satisfactory results will accrue in the case of other cultivated crops by the employment of the wild types as parents in breeding operations. It is true that the other crops offer, perhaps, greater difficulties than the sugarcane for the adoption of this method on a wide scale, but it has to be remembered that the splitting of the atom was once considered almost insuperable but this has since been done. If the atom could be split to the complete ruination of at least one city over-night, agricultural research planned at a similar level might reasonably be expected to increase our crop yields to such a degree as to solve our food problem on a permanent basis particularly when combined with other methods of tackling the problem.

FRUIT PRODUCTS CONTROL ORDER

A CONFERENCE of manufacturers of fruit products was held on 13 and 14 May 1946 under the Chairmanship of Sir Pheroze M. Kharegat, Secretary, Department of Agriculture, Government of India at which various aspects of the Fruit Products Control Order were discussed. In order to be able to implement the recommendations of this Conference and to enable the manufacturers to make necessary preparations, and also to allow further time to those who have not yet applied for a licence, the operation of the Fruit Products Control Order has been postponed to 1 July 1946. All manufacturers of fruit products such as jams, jellies, marmalades, fruit juices, squashes, cordials, tomato juice and ketchup, *achars*, *chutneys*, *morabbas*, etc. should apply immediately for a licence to the Agricultural Marketing Adviser to the Government of India, The Mall, Delhi, so that they have the requisite licence before 1 July 1946, after which date they will not be able to manufacture without a licence. This rule, however, does not apply to small manufacturers in rural areas manufacturing not more than 200 lb. of *achars*, *morabbas*, etc. in a season.—*Department of Agriculture, Government of India.*

A SCHEME FOR AGRICULTURAL DEVELOPMENT

Shri Ranjan

Dean of the Faculty of Science, University of Allahabad

OF late much interest has been shown in the problems of Indian agriculture. Many proposals have been put forward for agricultural improvement in this country and these have been widely discussed. There are no two opinions that if the agriculture of the country has to be improved we will have to closely scrutinize the Russian Scheme for adoption. The machinery of Agriculture Departments, as it stands today, was admirably suited for a period ending with the beginning of the first World War. It is hopelessly outmoded now. Vast improvement in agricultural technique is taking place in other civilized countries while here both research work and the education of the agriculturist, in newer methods of cultivation, are practically non-existent. The Director of Agriculture quite naturally has all his time taken up by innumerable files and what little time is left to him is devoted to attending countless meetings. The most efficient and highly qualified Director with every desire to do research will find it impossible to undertake it because of his heavy administrative duties. It is lamentable that in spite of the huge sums of money spent on the 'grow more food' campaign no substantial increase in crop yields was noted. No amount of paper propaganda can increase yield unless the two basic requirements, viz. water and manure are adequately given to our major food crops. It is well-known that 100 to 200 per cent increase in yield is possible in suitably irrigated and manured lands. Immediate increase in food production cannot be achieved by extension of cultivation alone. In areas not irrigated by canals, even if *takavi* loan is given, there is neither skilled labour nor equipment with the cultivators for sinking numerous wells for irrigation. It is here that the labour discharged from our war industries and the demobilized soldiers could be usefully employed.

Under each engineer a batch of men with equipment forming a platoon can go to the villages, dig wells, hand them over to the villagers, and move on to the next place. The cost of the well may be charged to the village and recovered in small instalments spread over 20 years. The two million demobilized army men will form 20,000 units of 100 each. Even then if each unit would dig five wells in a year, it would take seven years to cover all the villages in India (there are approximately 750,000 villages). This would give roughly employment for seven years for all and a chance for all of them for gradual re-absorption into civilian life. In addition they may be utilized in connecting villages with the main highway arteries by village roads, in draining swampy areas, and in building up village schools and granaries for seeds, etc.

It is suggested that India is normally short by about a million tons of food grains. This amount is really insignificant and the shortage can easily be overcome by bringing into operation the above scheme. Along with this a long range programme may be drawn up to raise the level of Indian agriculture to that of the Western countries. This can be done firstly by separating the research work from the administrative work of the department and by appointing a scientist actively engaged in research work and giving him the status of a Director. In recent years, in some provinces, a new research staff has been appointed but it is desirable that this should be placed under the research Director who should guide them and his department should be directly responsible to a Committee or Board described later on. He should not be saddled with administrative work connected with the Agriculture Department, so that he can devote his whole time to research and only do such of the administrative work as is directly connected with the research schemes.

Secondly no scheme of Agricultural improvement can materialize unless a good number of public men are associated with that scheme. The establishment of a Board of Agriculture which should be the supreme body responsible for the agricultural improvement in a province is of utmost importance. This will be the supreme body under whose directive both the Directors—research and administrative—will work. The Minister of Agriculture should be the ex-officio Chairman of this Board.

The Director of Agriculture should be in charge of all district work, propaganda, seed

production and rural reconstruction work as is being done, possibly in Bombay. Since the Director of Agriculture will be freed from all the research work he can devote his time for the establishment of a seed farm in each district, for the production of seeds of improved strains evolved and recommended by the research stations for largescale distribution in the shortest possible time. For this class of work, the cost of establishment and the production cost of a 100-acre plot in each district of a province should be worked out on a commercial and self-supporting basis. This arrangement would only mean an initial outlay in the beginning and a working expense in the succeeding years.

If for each province a block grant of Rs. 5,00,000 is set apart for the purpose of opening several seed farms every year under the supervision and control of the Board, a chain of such farms would be scattered over a whole province and a large number of agriculture graduates coming out of the universities will be absorbed. Incidentally as intensive scale of cultivation will be carried on in these farms, they will solve the purpose of propaganda and demonstration in a visual manner.

This entails some clear cut policy to be adopted by the Government.

The Director of Agricultural Research must have sufficient funds to carry on intensive research programmes.

Every university must be given a substantial grant for equipment and research.

If the results of researches show any indication of their being translated into largescale industries, it should be the duty of the Government to finance and plan pilot plants before they are handed over to any party for commercial exploitation.

The proceedings of the Board, and the various activities of the Research Section and the work done under the direct supervision of the Director of Agriculture should be scrutinized by the Board and each of those items that are accepted should be published as bulletins in English and the language or languages of the province concerned. The research work should be published in scientific journals and concise extracts of works in the language or languages of the provinces.

All matters of agricultural interest, of work done in India and foreign countries, should be published in the language or languages of the province concerned from time to time.

Following the lines of the Royal Society of Agriculture in England, exhibitions should be organized once a year to place before the public the recent advances in agriculture and animal husbandry. Such exhibitions should rotate each year from district to district.

If possible at least one agricultural museum in each division should also be opened in each province.

The scheme outlined above is only in its barest outlines and gives both a short and a long term plan for agricultural development, and if it is put into operation, it will serve to increase agricultural production manifold. The population of the country is on an average increasing by five millions every year and unless some bold revolutionizing scheme is put forward, the spectre of famine will continue to haunt the country.

COVER ILLUSTRATION

The cover illustration depicts a scene of cultivation in an agricultural college in the Deccan. Photo by Mrs. Stan Harding. (*Courtesy of Bureau of Public Information, Government of India*).

POWDERY MILDEW OF ORANGES IN COORG

M. R. DEVARAJAN, B.Sc., (Ag.)
Head Research Worker, Orange Research Scheme, Coorg

COORG is noted for its *Loose Jacket* variety of oranges, nearly 12,000 acres being under this crop in this province. Propagation is from seed and the cultivation is done entirely under rain-fed conditions, as distinct from several other orange tracts in India. Oranges are grown in Coorg at altitudes ranging from 2,500 to 4,000 ft. above the sea-level and in areas with annual rainfall varying from 35 to 200 in. The nature of the soil is invariably black or red loam, and the land where the orange groves are raised is well-drained. Powdery mildew has been known in Coorg orange groves for a very long time, but only as a minor disease. In the year 1943, however, the disease assumed major importance on account of the wide-scale damage it did to the trees. There was hardly a single orange tree in Coorg which did not suffer from it during that particular year.

Symptoms

The symptoms of this disease are readily noticed and the disease is easily identified. Greenish white patches of mildew are generally manifest on the upper surface of the leaves, the most commonly affected parts being the young and actively growing leaves and twigs. Old leaves are not usually attacked. In severely affected cases, the entire lamina of the affected leaf is covered by the greenish white patches. Affected leaves shrivel, dry up and finally shed. The tissues of the twigs lose their colour and become yellow. The older leaves, if attacked, do not shrivel but get malformed. The trees therefore lose a considerable quantity of their tender foliage resulting in loss of vitality to the plant and impaired growth. In acute cases of attack where the twigs are also affected, the twigs themselves dry up, get shorn of their leaves and such trees present an appearance very similar to that of wither-tip. The damage done by mildew to nursery plants is particularly severe. Damp mornings, with a few hours of sunshine, appear to be the most favourable period for the onset of this disease.

Etiology of the disease

Dr B. B. Mundkur, Second Mycologist, Imperial Agricultural Research Institute, New Delhi, reported as follows on the mildewed citrus leaves sent to him:

'1. The citrus leaves are attacked by powdery mildew of which only the conidial stage is present. The conidia are 25-42×11-17u, hyaline, oval or slightly barrel-shaped, with rounded or slightly flattened appresoria.

2. The first collection of powdery mildew in India was in 1904 in the Nilgiri Hills and was investigated by Sir Edwin Butler who named it *Oidium citri* but the name was never effectively published. The conidial measurements as given by him are 27-35×12-15 u.

3. In 1915, Carter (Phytopathology, 5: 193-195) reported a powdery mildew on citrus from California to which he gave the name *Oidium tingitanium.* The conidia are stated to be 20-28×10-15 u.

4. Petch (1. c. 5 : 350 and 9 : 266) reported a powdery mildew on citrus from Ceylon whose conidia measured 36-42×15-18 u. The Coorg and Ceylon specimens have, it will be noted, more or less identical measurements. The disease occurs in Java also and the conidia of the Javan fungus measure, according to Fawcett (*Citrus Diseases and Their Control* 1936, p. 273), 35-38×11-13 u.

5. From the above it would appear that the conidia of *Oidium* on citrus in the Eastern Hemisphere are very much larger in size, especially in length, than the conidia of the *Oidium* occurring on citrus in the Western Hemisphere. Fawcett (i.c.) is inclined to the view that the oriental and the occidental species should be considered as identical but the sizes are so very different that I do not feel inclined to agree with that view and the record of *Oidium tingi'anium* Carter for India in Butler and Bisby's *Fungus of India* (1931, p. 148) is an error. The Indian *Oidium* is still an undetermined species and should be designated Oidium sp.'

Control measures

Two control measures were tried to check this disease. The first consisted in dusting with sulphur that can pass through a sieve with 200

meshes per square inch to the affected parts early in the morning, so that the sulphur may stick to the leaves wetted by dew. When dusting had to be done after the morning dew had disappeared, it was found to be advantageous to first spray the trees with water using a mystifier, and then to dust with sulphur. The second method consisted in spraying the mildew-affected plants with one per cent Bordeaux mixture. Of the above control measures, it was found that dusting with sulphur was more effective than spraying with Bordeaux mixture. Four demonstration plots were laid out involving three hundred plants affected by the mildew disease for each treatment, viz. (1) dusting with sulphur, (2) spraying with one per cent Bordeaux mixture and (3) control. In all the places, such dusting with sulphur gave very satisfactory results by checking the disease completely and also its spread.

A pound of sulphur, costing Rs. 1-4, was found to be sufficient for dusting 100, two to four year old orange plants or 10 adult trees. Hence, it is very economical to resort to dusting with sulphur dust as a remedial measure to check powdery mildew. If neglected, the disease is likely to cause reduction in the productive capacity of the plant, on account of the loss of young leaves and twigs which are likely to bear flowers.

Acknowledgment

I am grateful to Dr Mundkur for the above report and for the advice he has given in carrying out the work on the control measures of this disease. It must also be stated that research work on this subject was possible as a result of the financial help given by the Imperial Council of Agricultural Research, New Delhi, for the Coorg Orange Research Scheme.

2,4-D PROMISES USEFULNESS IN STOPPING WEEDS

2,4-D, the new weed-killing chemical, shows promise of being able to stop obnoxious growths before they even get started, in experiments at the United States Department of Agriculture's great experiment station at Beltsville, near Washington, D.C. A concentration equivalent to only 1·5 ounces of 2,4-D in the top inch of an acre of soil was found sufficient to prevent or materially retard the sprouting of weed seed of senistive species, such as wild mustard. The ordinary rate of application as a spray on foliage of grown weeds is 1·5 pounds per acre—16 times more than the seed treatment.

An important tactical consideration in using 2,4-D in this way is the loss of weed-killing power by the chemical in moist soil. It can therefore be used to kill the weeds in fallow fields in humid regions because it will no longer be there to harm crop plants the following season. On the other hand, the compound retains its plant-killing ability for as long as 12 to 18 months in really dry soil.—*Science News Letter* **49** (15); 229, 1946.

What the Scientists are doing

FACTS ABOUT FISHERIES

FISH is utilized both for food as well as for the manufacture of various products like manure, fish oil, etc. With a view to developing the fish resources in India, the Imperial Council of Agricultural Research is subsidizing several investigations which are in progress in various parts of the country. Identification of fry of *Cirrhina reba*, *Labeo bata* and *Barbus chola* have been made and the fry of *Clarius batrachus*, *Wallagonia attu*, *Labeo ronita* and *Catla catla* are under study. Experiments for determining the artificial and natural foods for *Jeol machh* and other fishes of economic importance show that the principal types take protozoon, crustaceans, small fishes fry, bottom debris, insect larvae, algae and also higher phanerogramic plants in general. *Jeol machh* have a greater liking for animal food, viz. crustaceans, insect larvae and flies, small fishes and fry, bottom debris, etc. Of the artificial foods *chuno* fish and shrimp gave the best results in case of *C. batrachus* and *H. fossilis*. As regards zonation, it has been observed that *C. catla* generally favours the surface of the water and *L. rohita* prefers the mid as well as the bottom waters. *L. Calbasu* and *C. mrigala* live in the bottom. The carp shows distinct mark of fatality at 6·8 pH. It has been ascertained that the suitable pH for the fishes to thrive is from 7·4 to 7·8. It has been observed that the growth of the carps is generally retarded in winter, and enhanced in summer and rainy season.

The breeding habits of *Colisa fasciate* and *Oryzius melastigma* have been studied both under natural and laboratory conditions. The life history of *Barbus conchanius* has been fully studied and the life histories of *O. punctatus*, *C. batrachus*, *L. gonius* and *W. attu* are in progress. Work on the life history of *O. melastigma* and observations on *Catla catla* have been completed while work on *L. rohita* is still under progress. In field work, it has been found that the fishes grow more in the sewage feeding *bheris* than in the ordinary fresh water ponds due to abundance of natural food in the *bheris*.

Under the Rural Piscicultural Scheme, Madras, systematic observations have been made on the several species of fish, viz. *Labeo Cuv. Chanos chanos* (*Forsk*), *Cyprinus carpil Linn*, *Wallagonia attu* (Bl. Schn.), *Lates calcarifer* Block and *Plynemus* Linn. Detailed studies have been carried out on the qualitative and quantitative analyses of the biota of the typical ponds and their correlation with the food of fishes, on physico-chemical factors and their variations in typical ponds and wells and on the effect of meteorological variations on fish life. The upper Indian carps *rahu* and *mrigal* have been successfully transported from Bengal and introduced in Madras. Transport of live fish and fish diseases and mortality were also investigated. Pon-eye and unsteady movements from the painful effects of sores caused by ecto-parasites in a specimen of *Carassius auratus* have been successfully treated with epsom salt and potassium permanganate baths. It has been observed that success during transport lies in avoiding over-crowding in containers.

A successful attempt has been made to establish identity of two common types of *Leptocephali* of the Madras plankton—Muraenesox of the Family Congridae and Muraena of the Family Muraenidae—by allowing them to metamorphose into the adult eels. Plankton collections made during the year contained post-larval stages of 10 genera belonging to nine families. Fish eggs from these collections were removed and kept alive under observation for studying the developmental stages.

Under the scheme at Bombay, 638 eggs and 3,394 fish larvae and post-larvae were obtained from 222 plankton samples collected during 1944-45. It was found that the temperature of sea-water is one of the important factors that control the breeding period and the rate of development of many marine organisms. Slight changes in salinity affect considerably the movements of marine animals. January, February and part of March were the most favourable months of the year for the occurrence of the plankton. During the rainy season, plankton samples were rather poor both in quality and quantity.

Under the Scheme for the Preservation of Fish as Food by Curing, Pickling and Smoking in Baroda State, 73 experiments were conducted

mostly on Bombay duck, *tura*, *hilsa* and prawns. A periodical examination and use of these as food were made and it was found that almost all the products kept good for periods ranging from one to eight months. The prawn in particular was successfully preserved for over six months and its attractive colour was retained.—H.K.L.

PRE-MILKING OF HEAVY PRODUCERS

SWELLING, inflammation, and physical strains on the udders were greatly reduced by the pre-milking practice, while no undesirable effects on the cows were apparent. Calves receiving milk from cows which had been pre-milked were more subject to nutritional disorders and experienced a much higher rate of mortality than those receiving normal colostrum. The holding of colostrum in frozen storage from cows which were not pre-milked appeared to offer a solution for this problem since the frozen colostrum could be thawed and successfully fed to young calves from the pre-milked dams.—H. P. Davis and G. W. Trimberger in the *Holstein-Friesian World*, **38** (1941), No. 8, pp. 7-8.

What would you like to know?

Enquiries regarding agriculture and animal husbandry should be addressed to the Directors of Agriculture and Veterinary Services in provinces and states. This section is reserved for replies to selected letters in cases where it seems that the information may be of general interest.

Q. I have often been told that cattle ticks are a source of considerable loss to the livestock-owner and ultimately to the hide-merchant. Which is the latest and most efficient method for the control of these parasites ?

A. In view of the encouraging results reported to have been obtained with D.D.T. in various spheres of entomological research, some preliminary trials were carried out at the Imperial Veterinary Research Institute, Mukteswar-Kumaun, to determine the effect of this drug on cattle ticks in India.

Emulsions of D.D.T. were prepared in turpentine and in kerosene oil, using liquid soap as an emulsifying agent in each case. The concentrations employed were 0·1, 0·2, 0·5 and 1·0 per cent. Cattle heavily infested with ticks (*Boophilus australis* Fuller) were sprayed in batches with different concentrations of these emulsions. It was found that (i) D.D.T. in emulsion with turpentine at concentrations of 0·2 and 0·5 per cent, destroyed ticks in their larval, nymphal and male adult stages. The percentage of ticks destroyed varied from 80 to 90 per cent on sprayed cattle. Engorged female ticks did not seem to be affected, except that they failed to oviposit when incubated at 22° C. or 37° C. after each spraying, (ii) a single spray of D.D.T., in emulsion with kerosene oil and liquid soap at a concentration of 0·5 per cent, destroyed all stages of ticks within a period of a few minutes. In this case cent per cent tick mortality was observed. Turpentine or kerosene oil in emulsion with liquid soap when sprayed without the D.D.T., have practically no tickicidal value.

Experiments showed that, in the case of ticks, D.D.T. acted as a stomach poison and not as a contact poison or a repellent. The drug is non-poisonous to human beings and livestock.

As a point of practical utility it may be mentioned that D.D.T. emulsion can be used in the form of a hand-dressing, thereby eliminating the cost and complications involved in cattle-dips and sprays.—I.V.R.I.

MORE MILK : LESS COWS

IN the United States, although milk production on the farms during 1945 was the highest in the 21 years for which estimates are available, the number of cows on farms showed a sharp decline. The production per cow averaged 4,789 pounds, an increase of 214 pounds on the 1944 figures.—*Canadian Note.*

What's doing in All-India

UNITED PROVINCES

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During the war and the post-war periods, in order to maintain the health of nations on the fighting and home fronts, every country became conscious of the necessity of producing and providing adequate supplies of protective foods to its people as advocated by nutrition experts. Animal husbandry organizations in each country therefore set about to meet such demands by making better provision of nutritive foods like milk, butter, cheese, *ghee*, *khowa*, poultry, eggs and fish. The United Provinces Animal Husbandry Department after re-organizing its various sections early in 1944 have played an important part in this campaign.

Efforts to step up production of poultry and eggs

The United Provinces, thanks to the efforts of the United Provinces Poultry Association organized many years ago by the indefatigable Mrs. Fawkes, have been fortunate in having led the rest of India in the improvement and development of poultry industry. It became necessary to take over this Poultry Association under Government in this Department and the development of poultry on the one hand and the collection and plans for supplies on the other, were then set in motion. Two poultry development officers, one for the eastern and the other for the western United Provinces, are now functioning under the Chief Marketing Officer of the Department.

Production, diseases and marketing of poultry and eggs are so much interlinked that the staff engaged on these is working under the Chief Marketing Officer who is assisted by the Development Officers supervising all phases of poultry husbandry. A great drawback that hindered the development of poultry in the past appears to have been conquered by the discovery of a vaccine against Ranikhet disease after many years of hard work at Imperial Veterinary Research Institute, Mukteswar. As diseases in poultry have always been a stumbling block against developing this industry, it became necessary to have a separate Poultry Disease Control Officer and one is now functioning as such. On account of their greater egg-producing capacity, White Leghorn and Rhode Island Red are being multiplied and popularized.

Poultry extension activities in rural areas

Supplies to military were contracted for and the army made available to the Department wire netting, angle iron, incubators, etc. required for the expansion work. Branch and subsidiary poultry farms were opened which also acted as collection centres. This enabled to producers a ready and assured market and a source of supply of hatchable eggs and breeding stock at concessional rates for those who registered themselves at a nominal fee. Besides, the Central Poultry Farm at Lucknow, two branch farms at Moradabad and Fyzabad with four subsidiary farms under each at Amroha, Sambhal, Nagina, Bilari (Moradabad district) and Rudauli (Barabanki district), Partabgarh, Sultanpur and Shahganj (Jaunpur district) were started in the beginning and further farms have now been opened in Azamgarh, Gonda, Bahraich, Budaun, Hardoi, Rae Bareli and Shahjahanpur. The branch farms have a strength of ten pens, each pen consisting of ten hens and two cocks while the subsidiary farms have each five pens.

To meet the requirements of breeding stock at the branch and subsidiary districts farms, the Department's Central Poultry Farm, at Lucknow is functioning as a big hatchery having giant incubators and the breeding stock, duly reared and protected against Ranikhet disease, is issued to the district farms which also have their own hatching arrangements.

To encourage production, the following 16 districts were declared by the Government as selected districts:

Fyzabad, Jaunpur, Bara Banki, Sultanpur,

Partabgarh, Azamgarh, Basti, Hardoi, Lakhimpur Kheri, Rae Bareli, Bahraich, Gonda, Shahjahanpur, Badaun, Bijnor and Moradabad.

To these are being added the following five districts with effect from April, 1946:

Fatehpur, Allahabad, Mirzapur, Saharanpur, Muzaffarnagar.

In these selected districts we have registered poultry-keepers and registered poultry-farmers. A registered poultry-keeper is one who belongs to rural areas of the selected districts and pays a membership fee of annas four per annum, while a registered poultry-farmer comes of urban areas of selected districts and urban and rural areas of non-selected districts and pays a membership fee of Re. 1 per annum. The concessions allowed by the Government to a registered poultry-keeper are as follows:

Hatching eggs at the rate of 2 as. each. Birds of improved breed on free exchange basis or at the concession rate of Rs. 3 each. To a registered poultry-farmer the concessions are roughly half the market price but not less than the following:

Cock at Rs. 7-8
Hen at Rs. 6
One-day old chicks Rs. 9 per dozen
Hatching eggs Rs. 1-8 per dozen

Collections and civil and army supplies

A Central Poultry and Egg Godown was established at Lucknow to which all collections were directed and this became the main source of supply from where demands of the army all over the province were met. Another godown was later opened at Bareilly. At the Central Godown and at some district farms grading and candling of eggs are carried out. The surplus stock is made available for civil consumption. With the cessation of hostilities, the Department is still in contract for military supplies within the province, but naturally more stocks are now available and diverted for civil consumption.

The Civil Supply Scheme, started from April 1945, is working in seven cities—Shahjahanpur, Bareilly, Moradabad, Dehra Dun, Nainital, Lucknow and Fyzabad.

Besides, the supply of eggs and poultry noted below, about 12,000 Turkeys and a large number of ducks and geese and guinea-fowls were also arranged for the army. The following figures show supplies of eggs and fowls for army and civil consumption from the Central Poultry Godowns at Lucknow and Bareilly and also indicate the rapid progress made in the development of this industry.

Army			Civil		
	Eggs	Fowls		Eggs	Fowls
April, 1944	2,12,533	5,794		..	..
July, 1944	2,68,994	10,154		..	..
October, 1944	3,81,186	13,650		..	..
January, 1945	3,55,395	13,094		..	..
April, 1945	8,61,342	14,753	April to June, 1945	2,09,474	257
July, 1945	4,66,098	27,712	July to September, 1945	4,21,384	1,973
October, 1945	5,06,776	23,665	October to December, 1945	4,49,476	285
January, 1946	4,24,073	14,491			

All-United Provinces Poultry Show, 1946

For the first time after many years a very large poultry show was held at Lucknow in February, 1946. This attracted a record entry of 1,800 birds and was well-organized having propaganda stalls. A sum of Rs. 2,000 in cash and cups was awarded as prizes. The All-India Poultry Club held its annual general meeting at the time of this show.

Training in poultry husbandry is being imparted to the military personnel and civilians at the Government Central Poultry Farm, Lucknow.

The pioneer work of poultry development was also continued by the interested mission and other workers at Etah and other places. A number of egg-grading centres under the *Agmark* scheme of the Central Agricultural Marketing Department also continued to function and help develop the industry.

Poultry disease control

Besides a separate Poultry Disease Control Officer, a scheme for the investigation of poultry diseases in the province under the charge of an Assistant Disease Investigation Officer (Poultry), partly financed by Imperial Council of Agricultural Research, is also functioning.

The following poultry diseases occur in order of their frequency and economic importance:

1. Ranikhet disease
2. Fowl cholera
3. Fowl pox (complex)
4. Parasitic diseases
5. Spirochaetosis
6. Tick-anaemia
7. Coccidiosis and
8. Tuberculosis

Successful vaccination, that has withstood a virulent dose of virus, against Ranikhet disease has been carried out on all Government stock and 5,084 vaccinations were performed during the quarter ending October, 1945, and 1,621 during the quarter ending December, 1945.

In the use of vaccine against Ranikhet disease a minor reaction in the shape of paralysis and a drop in egg production is noticed which gradually passes off. A total of 4,273 fowls were subjected to the tuberculin test till August 1945. Infection was traced in about 2·03 per cent cases all of which were farm bred and no infection could be traced in village birds which numbered nearly 2,240.

NORTH-WEST FRONTIER PROVINCE

P. C. Raheja

It is usual to receive on the average about seven inches of rainfall during the winter months. This not only helps the *rabi* crops to grow out and yield a normal harvest but reduces the gravity of the frost effect, on crops susceptible to it.

Seasonal effect on rabi *crops*

Contrary to expectation the earlier part of the winter season was dry. But for the rains in autumn *rabi* crops would not have been sown. The effect was that not only crops suffered from lack of soil moisture, the frost effect, due to aridity, was comparatively very marked on the susceptible crops. Thus sugarcane, citrus, clover, early peas, tobacco nursery, etc. were very badly affected. The foliage of sugarcane was completely killed by frosts and inversion of sucrose was recorded in the months of January and February. The mill recovery of sugar on cane was reduced to 7·0 per cent, compared to December recovery of 8·5 per cent. This reduced the recovery of *gur* as well. Besides from March onwards the gur would not set. But for high prevailing *gur* prices the cultivators would have suffered an immense financial loss. Recently planted orchards of citrus particularly of sweet lime raised on *khathi* stock completely dried up. Washington navel citrus fruit tended to become fibrous and lose its juiciness. The fruit lost its storage quality and had a short market season. Late sown crop of clover following maize was late to grow out. This entailed a loss of a cutting of the fodder crop. The early crop of peas had very poor seed setting and green peas when harvested for market fetched low price. Autumn-planted tobacco completely succumbed to the frost bite. Similarly tobacco nursery had to be resown for spring crop.

Lack of soil moisture early in the season reduced tillering of *barani* crops. Late in January and in early February widespread showers of rains raised the prospects of a fair *rabi* harvest. Late season rains, however, have been negligible and in consequence the wheat crop has matured earlier by about ten days and grain size is smaller than normal. In irrigated areas the crops did not suffer from shortage of water. Therefore, acute shortage of food grains is not likely to be experienced in the near future.

Crop cutting experiments on wheat

The final report of the crop cutting sampling survey was received in February last. Results indicated that sampling unit of 1/80th of an acre can be adopted throughout the province. Plot size smaller than 1/80th will not yield reliable results. For the province as a whole the eye estimate was lower by eight per cent than the survey estimate. Improved varieties including mixtures were estimated to be growing over approximately 40 per cent of the area under wheat. Local types occupy the rest of the 60 per cent of the area. Without admixture the improved types occupy slightly over 30 per cent of the area under wheat. The improved varieties have more extensively spread under irrigated than unirrigated conditions. Only 20 per cent of the wheat area is manured exclusively by farmyard manure.

Irrespective of the manuring and soil types the mean yield of improved and local types under irrigated conditions is estimated at 11·4 and 8·1 md. respectively. Under unirrigated conditions the respective estimates were 7·4 and 5·8 md. Evidently yield under irrigated conditions was higher than under unirrigated conditions. The irrigated and unirrigated estimated mean yields per acre were 9·99 and 6·62 md. respectively. Last year's total production estimated by sampling survey amounted to 3,09,139 tons for the six settled districts and Kurram agency.

Welfare education of soldiers

A selected number of soldiers are deputed by the military authorities to undergo 12 weeks' training course in practical agriculture. A practical course definitely with a rural bias was framed to train them up in improved methods that would be a departure from the old stereotyped technique of agriculture. For instance raising of nursery stock, planting of orchards, introduction of improved seed types of fodder, sugar, corn and other cash crops, utilization of waste products of agriculture, i.e. pit system of compost manufacture, preparation of squashes, marmalades, jams, etc. to utilize unmarketed fruits, control of common serious pests and diseases, hygienic cultivation of crops and fruit plants, etc. are included in their course. In days of high prices the cultivator obtains money which he seldom puts back into bank to be of use when wanted. In order to inculcate this habit the trainees are taught simple methods of book-keeping and it is impressed upon them to be thrifty when they are apparently rich. So far four groups have been trained at the Agricultural Research Station, Tarnab. Besides, the demonstration and propaganda staff at the cantonments headquarters, assist the military staff in imparting practical training to the soldiers at their various farms, i.e. military dairy and grass farms.

Provincial Sugarcane Committee

The Provincial Sugarcane Committee constituted by the Provincial Government in accordance with the recommendations of the Indian Central Sugarcane Committee held its first meeting on 11 December, 1945. After the preliminaries were over the Provincial Committee considered the programme of the Sugarcane Research Station for the next five years in the light of the results achieved during the past five years. The Committee generally approved the programme and recommended that the scheme be given extension for the period of five years on the basis recommended by the Imperial Sugarcane Expert in his report entitled *Survey of Sugarcane Research in India.* The Committee further recommended that work on the problems of *gur* manufacture and demonstration of improved methods of *gur* preparation should be immediately taken up by the Government. The members complained of the acute shortage of cane crushers when the resolution of the Indian Central Sugarcane Committee on the subject was discussed and the proposal to take up manufacture of agricultural implements as a Government industry was adopted. The question of short term credit facilities for storage of *gur* against stock was the next agenda considered by the Committee. The licensed warehouse system as proposed by the Reserve Bank of India constituted a sound solution of the problem and all the members were agreed that legislation be passed to give effect to the draft proposal of the Reserve Bank of India. This bill has since been passed by the Provincial Legislative Assembly during its last budget session.

At its second meeting held on 28 February, 1946 the matter of the organization of warehouses was taken up by the Provincial Committee. After some deliberation a subcommittee was appointed to draw up plans for putting up an experimental warehouse of *gur*, on cooperative lines at Hathian, one of the important *gur*-producing centres in the Peshawar Valley. To avoid delay the sub-committee was directed to simultaneously submit their detailed proposals to the Provincial Government and the Committee. The sub-committee was directed to consider arrangements for storage of grade I *Agmark* quality of *gur*.

The draft of the Sugar Factories Control Act, drawn up on the lines of the United Provinces Sugar Factories Control Bill was next considered by the Committee. The members were generally agreed that, though a little premature, such an enactment is desirable in the interests of the sugar industry and the cane growers in regulating supply of cane to the factory. It was, however, stressed that an amount equivalent to the cess levied and collected by the Government should be utilized by the Government for cane development and objects ancillary to it. The opinion of the Committee on the subject was communicated to the Government with the proposed enactment.

BIHAR

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The winter rains were untimely destroying mango blossoms and not beneficial to any crops other than late-sown wheat. The prospect of wheat harvest in North Bihar is estimated to have been reduced to 10 annas in the case of normal sowing and 6 annas for the late-sown crop. In Tirhut Range 6,457 md. of oilcakes and 287 md. of fertilizers were sold during the quarter ending 28 February 1946. In Patna Range the corresponding figures were 2,926 md. and 1,513 md. There was an extreme shortage of oilcakes. In Tirhut Range 711 md. of seed grains and 280 lb. of vegetable seeds were sold, and in Patna Range 900 md. of sugarcane seeds and 165 lb. of vegetable seeds were sold. In Tirhut Range 12 minor irrigation works benefiting 2,513 acres were constructed at a cost of 8,517. In Patna Range 396 schemes were under execution. Owing to protracted drought that prevailed during the grand growth period of the sugarcane crop in July-August 1945, the general sugar recovery was lower by 0·5 units as compared to last year's figure. Wilt trouble was serious in light soils of Hathwa, Pratabpur, Motipur and Motihari. Losses due to whitefly trouble which were confined to paddy land of Shahabad and Gaya districts were not great. A cheap and easy process for making excellent quality *gur* from inferior cane varieties such as Co.395 and Co.453 has been developed at the Sugarcane Research Station, Pusa. The process consists of (i) clarification by the addition of water extracts from crushed castor seeds and (ii) brisk agitation of the viscous mass just before pouring into moulds. The additional cost is one anna per maund of *gur*. *Gur* thus obtained is of light colour and of good taste. The planting of cane was taken up after 15 January 1946 and nearly 50 per cent of the area has been planted by the end of February. Co.331 in South Bihar suffered deterioration due to red rot and therefore large quantity of seed material of Co.453 and B.O.11 has been distributed throughout South Bihar. To encourage the growing of hot weather catch crops such as maize, cheena and vegetables the Government has decided to supply seeds free of cost and irrigation water free of charge in Dehri, Fatwah and Bihar Sharif areas.

ERRATUM

Indian Farming, Vol. VII, No. 1, January 1946, page 8, author's name :
for 'S. B. Mogra, M.Sc.'
read 'S. B. Mogre, M.Sc.'

BARLEY

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IN certain districts in New Zealand where the soil and climatic conditions are suitable for its production barley has become an important crop. It is grown for three purposes: for the production of malting barley, of food barley, and of greenfeed. New Zealand's requirements of barley for malting and for stock food are about 2,000,000 bushels yearly, and in this article the cultural and harvesting practices which have been developed in the production of the crop are described.

Following the introduction of a protected market, a minimum price schedule, and grading standards New Zealand quickly became almost self-supporting in the production of malting barley, but large quantities of feed barley for the pig industry have to be imported each year. In the South Island barley which has been rejected for malting purposes is used as stock feed and any surplus is sold to the North Island, but to meet the deficiency in the North feed barley has to be imported.

In the 1943-44 season a total of 35,811 acres was sown to barley, 7,570 acres being utilized as greenfeed. As a greenfeed crop barley is useful for two main purposes: for the provision of winter and early spring feed and to provide feed in low-rainfall areas during the dry period. Barley has an advantage over other cereals in that it is a rapid grower and recovers quickly after grazing. The Cape and Black Skinless varieties are popular for this purpose.

Of the total area of barley grown in the Dominion 3,913 acres were grown in the North Island, and of this 2,825 acres were devoted to greenfeed, the remainder being harvested and used as stock food. In the South Island a total of 31,898 acres was grown with some 4,745 acres utilized for greenfeed.

From the foregoing it will be seen that the growing of barley is mainly confined to the South Island. The following table shows the acreages grown and the utilization of the crop in the different provinces of the South Island for the 1943-44 harvest:

Province		Acreage of barley for threshing	Acreage of barley for greenfeed
Nelson	..	1,491	158
Marlborough	..	3,193	227
Canterbury	..	18,077	2,295
Otago	..	4,242	1,761
Southland	..	150	304
Total	..	27,153	4,745

Because of the suitability of the soil and climate, practically all the barley harvested in the South Island is for malting purposes, only sufficient of the greenfeed varieties being harvested to meet the requirements for seed.

Soil and climate

Any soil which will yield good crops of wheat or oats in a normal season can generally be regarded as suitable for barley. For greenfeed the crop may be grown on a fairly wide range of soil types, but for malting purposes, because of the high standard of quality of the grain required, the crop has been confined to those districts which have proved themselves to be suitable for its production. The localities considered most suitable for malting barley are Marlborough, Canterbury, North Otago, and parts of Central Otago and Southland. In Canterbury, where the major portion of the crop is grown, the main counties are Ellesmere, Springs, Selwyn, and Ashburton.

The most suitable soils are the uniform medium to rich free-working loams adequately supplied with lime. Climate plays a most important part in the production of good-quality malting barley, and an adequate supply of moisture during the growing season is required. Relatively dry conditions are essential during the harvesting period. Excess rainfall at this time results in sprouted grain or grain in poor condition.

Preparation of seed-bed

The preparation of the land intended for barley is similar to that required for wheat or oats. The land should be ploughed to a good depth and a well-cultivated seed-bed developed. The amount of work required to be put into its preparation will depend largely upon the type of soil and the preceding crop. On most soils some preliminary cultivation is usually undertaken before the final deep ploughing, but on some of the heavier soils where natural drainage is not good the land may be ploughed only once and allowed to remain in the furrow through the winter. To assist in drainage ploughing is at times done in comparatively narrow lands.

Where the crop is to be spring-sown, and the bulk of it is sown at that period, early winter ploughing is desirable, as it ensures good weathering of the soil, and subsequent cultivations interspersed with rolling and harrowing will produce the consolidation and tilth required. It is best to delay this work until the soil is fit, as working wet soil has harmful effects on the seed-bed, especially with some of the stiffer soils.

If the ground is inclined to be weedy, it is sometimes advisable to delay sowing beyond the normal period, so as to allow for a further killing of weeds before sowing takes place, but comparatively few crops are sown later than the early part of November.

Place in rotation

Barley is generally a spring-sown crop and may follow a cleaning crop such as roots or potatoes or after peas, wheat, or grass. Barley does not demand such a high fertility as wheat and can quite profitably follow wheat in the rotation. In the drier districts barley is often grown after a bare fallow following a previous barley crop. The fact that barley does not compete successfully with weeds often determines the place it takes in the rotation. Barley is often sown on land intended for wheat where sowings of the latter crop have been delayed by weather conditions and the prospects of a good wheat crop are poor. As a catch crop to provide winter feed barley is often sown in the autumn after a cereal or in the early summer (November to December) to provide feed to tide over the dry period in late summer and early autumn when feed is in short supply.

Sowing

Spring sowing usually commences in August and is carried on through September and October. Occasional sowing takes place in November, but the prospects of securing a good sample and yield from such late sowing are too uncertain, and it is only where cultural work has been held up on account of weather conditions that such late sowings are practised. Normally the earlier the crop is in, the stronger it is and the better the yield. Occasionally autumn sowing is practised on the lighter and drier soils. In such cases drilling usually takes place in May or June.

For malting barley seedings may range from 1¼ to 2 bushels per acre. These quantities may vary from district to district, the rates adopted being those which have proved most suitable for the locality. The aim should be a seeding which will give a maximum yield of well-developed grain.

For greenfeed, where the main object is the production of a quick bulk of fodder, seedings of 2 to 2½ and even 3 bushels per acre are common, the last quantity being most generally used when the seed requires to be broadcast.

The use of superphosphate at 1 cwt. per acre can be recommended. The normal depth of sowing is about 2 in., and the land is harrowed following drilling.

Barley is sometimes rolled after the crop is up, when it is considered necessary to level and consolidate the seed-bed. The crop is also harrowed when weeds are prevalent. As barley is rather delicate in the seedling stage, anything in the nature of drastic treatment should, however, be avoided.

Varieties : feed barleys

The two varieties most commonly used are Cape and Black Skinless, which are quick growers and produce a great bulk of feed in a very short time. Under normal conditions the crop will be ready for feeding off within 6 to 8 weeks of sowing. Besides producing a bulk of greenfeed, these varieties produce good yields of grain suitable for pig feed, but not for malting. Feed barleys are of the six-rowed type.

Black Skinless: This variety is quicker growing, produces a bigger bulk of feed, and recovers better after grazing than Cape barley.

Cape barley: This variety has a longer growing period before running to seed than Black Skinless, and is also more drought-resistant.

Malting varieties: The chief varieties of malting barley grown in New Zealand are those which have proved most suitable for malting purposes not only here but in the main barley-

growing countries of the world. They are nearly all hybrids whose parents lacked some essential quality, but when crossed have produced desirable characteristics of both parents. They are all of the two-rowed type.

Chevallier : This is one of the oldest varieties and is still giving satisfactory results, as shown by farmers' preference for it over all other varieties. It is tall growing and the head droops when ripe. It produces a plump grain of good quality, but is weak in the straw and tends to lodge no heavy land. Its straw weakness makes it more suitable for the medium to light lands.

Plumage-Archer : This is a hybrid which has combined the qualities of its parents, namely the straw quality of Archer and the grain quality of Plumage. It is short-strawed and a high yielder of good-quality grain. The head remains erect when ripe, but has a tendency to break off. Its strong straw and its resistance to lodging make this variety highly suitable for growing on the heavy soils, but it can be used for most types of land.

Spratt-Archer : This is another hybrid. It is short-strawed and a high yielder of very good quality grain. It is largely used for autumn sowing in Central Otago. Because of its straw quality it is suitable for growing on medium to heavy soils. The head of this variety droops when ripe.

Goldthorpe-Spratt : This is a variety which has given good results in Marlborough, Southland, and in parts of Central Otago where spring sowing is practised. It is one of the more recent varieties introduced, but is not recommended for the heavier soils because of its tendency to lodge.

Breeding of new varieties has been carried out by the Agronomy Division, Lincoln, and hybrid which promises well has recently been handed over to a commercial firm for testing and increasing.

Of the four varieties grown Spratt-Archer is considered the best malting quality. The other three, Plumage-Archer, Chevallier, and Goldthorpe-Spratt, are about equal. Of the total area in barley, Chevallier occupies 40 per cent, Spratt-Archer and Plumage-Archer 20 per cent each, Goldthorpe-Spratt 6 per cent, and feed barleys 14 per cent.

Securing reliable seed

As over 80 per cent of the barley grown is for malting purposes, more care has been taken with these varieties than with the feed barleys in maintaining pure stocks of seed. Varietal purity is most important. Most varieties differ in time of maturing, therefore the sowing of impure seed results in a poor sample, which eventually means a drop in the malt extract of the line. Consequently the maltsters and brewers who have the crop grown on contract by the farmer each year select for seed purposes the produce of these crops which are most free from disease and varietal impurities. Thus a supply of seed of satisfactory purity and relatively free from disease is made available to growers.

Disease and control

The most common diseases of barley are covered smut, loose smut, and leaf stripe.

Covered smut : Diseased grains are filled with a mass of black foetid spores which are blown about by the wind and spread by threshing machines. Since the spores adhere to the outside of the grain, they can easily be destroyed by one or other of the cheap and effective fungicides.

The dusting of the seed with one of the proprietary organic mercurial dusts is the simplest and most common method of seed treatment and one which can be recommended. It is easily undertaken by the farmer himself if he has a suitable type of agitator, but practically all lines of seed are now treated by this method before being sent out to the grower. The dust is applied at the rate of 2 oz. per bushel of seed.

Another method of seed treatment is to use either a formalin or a bluestone solution. In the former case a solution of one pint of formalin (40 per cent concentration) in 40 gallons of water can be sprinkled on a heap of grain on the floor, 1 gallon per bushel, or the grain can be immersed in a trough for 10 minutes and allowed to drain for at least 12 hours before sowing. If using the trough method, half-bag lots should be used. Germination of the seed is affected, especially if the seed is allowed to dry. In the latter case 1 oz. of bluestone per quart of water is sprayed over a bushel of seed and the seed well mixed. If used as a steep, a 1 per cent solution should be used (1 lb. to 10 gallons), and the seed allowed to soak for 10 minutes. Bluestone lowers the germination.

Covered smut is also controlled by hot water treatment (see below)

Loose smut : This disease is characterized by a loose mass of black spores which, when blown away by the wind, leaves the bare stalk. The disease is internally seed-borne and cannot

be controlled, the only means of control being by hot water treatment, which consists of pre-soaking the seed for 5 hours at 70°F. followed by 5 minutes at 127°F. This is a somewhat intricate process requiring special knowledge and equipment and should not be attempted on the farm. In recent years maltsters have treated a high proportion of the seed in this way and disease in the malting varieties has been almost eliminated.

Leaf stripe: This disease is characterized by the striped appearance of the leaves. The stripes are first yellow, but turn brown, and finally the leaf splits along these lines. The ears of infected plants often fail to develop and sometimes do not emerge from the sheath. The plants are stunted in growth. There is no effective means of control.

Two other diseases of lesser importance are 'rust' and 'take all'. There is no means of control for 'rust' and the incidence of the disease is due to climatic conditions. 'Take all' can be controlled only by crop rotation.

Harvesting

Barley should be fully ripe before cutting. At this stage all green colour has disappeared from the straw and the grain is hard and the skin finely wrinkled. The above is only a guide; the exact time to cut must be left to the individual. Where ripening is uniform no difficulties are presented, but crops which are uneven in ripening because of variation in soil present problems. Most of the varieties grown today can be left with reasonable safety until fully ripe before cutting. It is only in the case of uneven ripening or where the variety sown has a tendency to break at the neck if left too long that the farmer is faced with the question of when and how to harvest his crop without loss.

The most common practice is to cut with the binder and to leave in stook 7 to 14 days or longer according to weather conditions. The crop may then be stacked or threshed from the stook. Another method is to windrow the crop and to thresh from the windrow with the header harvester with pick-up attachment. Direct heading of the crop is not common, although this means of harvesting is increasing. For direct heading the crop must be even and left beyond the stage considered ripe for binder-cutting. With the varieties grown at present the danger from wind damage and consequent loss is too great to make this method popular.

The brewers and maltsters prefer barley from a crop which has been stacked rather than stook-threshed, windrowed, or direct-headed grain. They prefer grain threshed from the stack because while in stack the moisture content evens up and the grain germinates evenly when malted.

Threshing

It is often at this stage of harvesting that good crops are ruined, both for malting and for seed purposes, and the grower finds that instead of having grain of good malting quality or a good germinating line of seed, he is obliged to sell the grain for stock food. In many cases the germ is removed or badly damaged and this affects the germination capacity of the line, or the grain may be cracked or skinned. These features are all important to the maltsters. Grain which has had the germ removed will not germinate and the broken and cracked grains develop mould on the malt floor and this impairs the quality of the malt.

The presence of such damage is usually caused by setting the concave too close to the drum or driving with too high a drum speed. For efficient threshing it is advisable to reduce the drum speed below that required for threshing wheat. While it is necessary to reduce the speed of the drum, it is highly desirable to maintain the high speed of the shakers to assist in the separation of the grain from the straw. This may be achieved by an adjustment to the pulley which drives the belt to the shaker shaft pulley. With the variations in crop, and the changing of humidity and temperature frequent adjustments to the setting of the concave or alteration in drum speed may be necessary during the day's threshing to avoid injury to the grain. Regular feeding is also important. A good malting sample is one which is dry, plump, bright, sound, and free from other seeds. Too close clipping will give a better bushel weight but usually results in skinning. A little of the awn should be left on the grain.

If the grain is for malting, it is left in the field after threshing until inspected by the buyer, who grades it according to sample. If accepted, it is delivered to the buyers free on trucks or in stores according to the district. If rejected, it is disposed of by the grower as feed barley.

Grades

There are four grades for malting barley. Certain standards have been set up to cover the requirements of these grades and each

grade is covered by a minimum price. Each year the Barley Advisory Committee fixes a minimum price for malting barley. The grower has the right of appeal, and appeals against grading can be made through the Department of Agriculture.—Reproduced from *New Zealand Journal of Agriculture*, January 15, 1946.

BUTTER WITHOUT CHURNING

A NEW process of making butter without churning was explained at a meeting of the Institution of British Agricultural Engineers in London by Mr. J. J. Mathews, a leading dairy technologist, says the *Yorkshire Post*.

The separators used produced cream of high fat content which undergoes the phase of inversion from fat in serum (which is cream) to serum in fat, which is butter.

The Senn unit, called after its Swiss inventor, Dr. James Senn, produces this inversion by using carbon-dioxide gas under pressure, and packed slabs of butter emerge five minutes after the cream is put in, as against the usual 45 to 60 minutes' churning.

The machine is totally enclosed, so that the butter never makes contact with light or air until it is opened by the consumer.—*Capital*, May 9, 1946.

The Month's Clip

WELL IRRIGATION IN COIMBATORE

IN a paper on 'Economics of Largescale Farming Under Well Irrigation in Coimbatore,' read at the last session of the Agricultural Economic Conference, Prof. Ramkrishnan of the Agricultural College, Coimbatore, makes a study of the largescale development of 'garden' cultivation, i.e. of farming under well irrigation with the aid of electric power, improved implements and machinery that has been going on for the last ten or twelve years in and around Coimbatore served by the Pykara Hydro-electric Power-Scheme. Garden cultivation had been for long confined only to a few acres of land, ten at the most, irrigated by a well or two with bullocks lifts. A pair of bullocks could not tackle more than 3 or 4 acres, nor could a ryot unaided look after a larger area. The introduction, early this century, of the internal combustion engine led to some expansion of the area under garden cultivation, but not much because the initial cost of oil engine or gas engine was high—particularly the latter—in those years when there was little surplus capital among agriculturists and there was no industrialist who was interested in the improvement of agriculture as a side line. The oil engine was cheaper on large farms with an abundant supply of water permitting heavy pumping and long working hours. But the wells of Coimbatore were deep and rocky and the supply of water would go down during summer, needing an alteration of the bed for the engine, which was difficult and well-nigh impossible in some cases. Not so with the electric motor which could be shifted to temporary beds at different heights. The electric motor requires less space, is cheaper, and easier to operate with a wide range of water supply.

Expansion of garden cultivation

It is the advent of cheap electricity from the hydro-electric power scheme of Pykara twelve years ago that has greatly accelerated the pace of enlargement and consolidation of holdings, the deepening and widening of wells, the introduction of improved implements and machinery and the lavish application of manures. This development closely followed the swift expansion of cotton industry in the Coimbatore district, which again was entirely due to the supply of cheap electric power. It is the interest taken by men who made money in the cotton trade or industry in the development of agriculture as a side line that accounts for far more expansion of garden cultivation than the exertion of local land-holders of influence in buying and improving land. A lot of dryland has been converted into gardenland, holdings have been acquired, consolidated and enlarged; old wells have been deepened and widened if water supply therein was promising, or closed if the supply was poor and unpromising. Investment of Rs. 5,000 to Rs. 10,000 per well is quite common, and there are wells which have cost Rs. 20,000 to Rs. 30,000.

The extension of garden cultivation proceeded much in the same as the enclosure movement in England, often by more reprehensible practices such as buying adjacent land and putting in deep bore, new or in an already existing well, close by the land coveted, which had the effect of drawing away the water from the well of the recalcitrant neighbour. A good gardenland becomes a dry derelict farm, for which no compensation has been provided for in our law as it is said to be in the U.S.A.

All-round improvements in land effected

It must, however, be said that unlike most buyers of land elsewhere in our country, these investors in land in Coimbatore have not been content to leave the land as it is, nor chary of putting in enough working capital to raise the yield. Lots of money and effort have been spent in terracing, levelling, enclosing and draining the land when labour was not so dear as now. A few pairs of carts, if not a lorry, are engaged in carrying huge quantities of tank-silt and, if forests are nearby, in fetching plenty of green leaves, particularly *kolinji* (wild indigo), to apply to the land to improve the soil and rectify alkalinity. Most of this work is done in the off season, when animals and labour are not engaged in agricultural operations. Roads are laid out to carry

manures into, and produce out of the farm. Farm buildings to shelter permanent farm servants, cattle and implements and granaries are erected in pucca style. It is to the sinking of new wells, and the widening and deepening of promising old wells that the greatest effort is directed in the initial stages. For it is on their success that the farm flourishes. Thousands of rupees are spent on them and on the masonry work connected, on cisterns of brick and cement to which water is pumped from the well so as to irrigate from there fields lying at different levels and on open irrigation channels lined with cement, and on underground pipe lines of glazed earthenware of reinforced cement pipes. Close wirefencing or the building of a stone-and-mud wall all round the farm is considered essential, especially in areas near hills or forests where a mere live hedge of aloe or some other plant is not enough to keep off the attack of wild bears or other animals.

Electric pumping

By 1940, electric pumping became so popular in the Coimbatore District that out of 2,200 pumps in the Pykara Electric Distribution, 1,240 were found in five talukas of this district. Some big owners of gardenlands who wavered to go in for electricity because they had oil or gas engines with cheaper working cost, and many small owners who were content to carry on with bullock mhote, unwilling to spend comparatively small initial capital on electric motors and pumps are bitterly repenting now for their hesitancy; the former because the prices of crude oil and charcoal have gone up and crude oil is not available in required quantities. Spare parts for engines are difficult to get and, even more, mechanics to attend to repairs in time. All the time the rate charged for electricity has remained stable—nine annas per unit. The small holders suffer no less acutely because of the rise in the price of cattle and of all cattle feeds by 200 to 300 per cent and of wages for labour by at least 100 per cent even in villages far away from urban, industrial or commercial centres. There can be no greater propaganda for electric drive than the suffering endured during the war by small owners as well as the big.

Those who had installed electric motor before 1940 for pumping and other purposes on the farm have gained a great deal by it. It has taken off the very heavy strain on bullocks entailed in lifting water from the uncommonly deep wells of Coimbatore which led to their rapid deterioration, and improved the condition of animals which had only to do ploughing and other work on the farm and carting from and to the farm. More than that, it reduced the number of animals that needed to be kept on the farm for drought, and the area devoted to the growing of fodder at the expense of food and commercial crops fetching much higher prices.

Use of improved implements

Some of the improved implements and machinery used on the big garden farms are worth noting. There are only four or five big farms which have used tractors for ploughing, with the mouldboard plough and the disc plough, harrowing, rolling, etc. A 200-acre holding, having 150 acres at a time of Cambodia cotton which grows to a height of 5 or 6 ft. with thick stems, profited by disc ploughing and harrowing which cut and ploughed in the cotton stalks at a lower cost than it would be by human labour, and at a quicker pace, which is more important for sowing summer *cholam* (*jowar*) in time and the depth tilled was greater which resulted in less weeds and more yield of crops. A tractor can well be economically utilized for the above and other operations on holdings of more than 100 acres each, where farming is so intensive. Threshing and winnowing machines are owned by a few. The cost of threshing and winnowing *ragi* by electric power was just half of what it was by bullock threshing and hand winnowing before the war. Now bullock power and manual labour are far more costly while electric power is as cheap as before; and therefore power threshing and winnowing are likely to win favour with big farmers. The chaff-cutter driven by electric power cuts *cholam* (*jowar*) stalks fed to cattle in this district into smaller bits than can be done by hand easily, which means less wastage and it does it at half the cost. It is naturally popular in the large farms needing a few tons of fodder per day for all the animals. Wherever, sugarcane is grown on 10 acres or more the power crusher with at least a 7·5 H.P. electric motor, crushing half a ton of cane per hour, is sure to be found. It does the work more quickly, cheaply and efficiently than the bullock-driven iron roller. It can crush 4 or 5 tons per day as against 3/4 ton by the bullock mill and at a little less than half the cost per ton; and it extracts 10 to 15 per cent more of juice from the cane. As

regards the improved implements of tillage, several brands of soil-inverting iron ploughs are used in the cultivation of garden crops unlike in paddy where the old wooden plough is preferred. In the cultivation of cotton, and even more of sugarcane, the ridgeplough is found to be at least twice as economical as getting ridges done by the manual labour of 8 to 10 men per acre. The bund-former is even more popular and economical in the cultivation of summer *cholam* as it requires only a pair of cattle and one man to form bunds or beds and four more men to correct them on four acres per day costing in all Rs. 10 at the most, while if done without that implement 20 men would be required for four acres and cost Rs. 30 in wages. The 'junior Hoe' is another useful implement in the intercultivation in cotton. Two acres can be weeded by this hoe driven by a pair of bullocks and a man and six women coolies to complete it while if women alone do the weeding, as many as 16 women will be required for the area and the weeding cannot be so effective.

Control of labour

The larger gardenland owner has a greater command over labour, though the wages paid are not higher than in the market nor hours worked smaller. The labourers are even prepared to work slightly longer hours or receive slightly lower wages on the bigger farms, because of the continuity of work which the landlord endeavours to provide not only for permanent farm servants but even for casual labourers paid by the day. This is possible in the diversified farming of big gardenlands. On days when there is no work on the field, part of the labour is turned on to the improvement of land, deepening and widening of wells, terracing, levelling and digging of land, and the fetching of tank silt or cartloads of green leaves for the manure from the neighbouring hills or forests.

Procurement of manures

The large gardenland owners have a decided advantage in the purchase or procurement of manures of all kinds at wholesale rates which are considerably more favourable than the retail rates at which poor farmers have to buy. Green leaves are procured by cartloads on their own carts by their own men from considerable distances, while the poor buy by head-loads at high prices. If there is a municipal town or *panchayat* union nearby, street rubbish is taken on auction by big farmers. With the extension of garden cultivation, poor ryots find it more and more difficult to secure enough manures, though they are prepared to pay a higher price. Municipalities and *panchayats* might well show a preference to them. Some of the big gardenland cultivators who produce onions, tobacco, chillies, and jaggery on a large scale and have been able to contract wholesale merchants in the distant consuming centres within the country and even Ceylon, get a distinctly higher price for their produce. Finally, these big farmers have shown a readiness to try the new strains of millets, cotton and sugarcane evolved by the crop specialists of the Agricultural Department on large areas, either at the instance of the Department or even independently if only they could procure enough seeds. It is in fact their example that has led to the spread of the best strains of Cambodia cotton throughout the district and the disappearance of older varieties.

Enterprising landlords

There is another interesting feature of the Coimbatore experiment. Intimate association with industry for some years has broadened the outlook of these new big landlords so far as investment in and improvement of land and cultivation are concerned, which years of preaching to landlords 'rooted in the soil' were not able to effect. Machinery, implements, fertilizers and new seeds are all bought and tried with avidity. Higher wages for labourers are paid without demur and schemes of labour welfare are set afoot. New methods of cultivation are sought after and practised in a manner that would strike the old critics of our agriculture with amazement. Sir John Russell reviewing the progress of agricultural research in India (1937) lamented the lack of a landed aristocracy among us analogous to the British landlords 'rooted in the soil', ready to try any improvements put forth by experimental stations and anxious themselves to devise improvements which are sometimes better than those of the experimental stations. We may have no landlords answering this description in Coimbatore, but the nearest approach to them may be found among the more enterprising gardenland owners of the district.—Reproduced from *The Eastern Economist*, February 8, 1946.

New Books and Reviews

NATURAL PRINCIPLES OF LAND USE

By Edward H. Graham (London, New York and Toronto: Oxford University Press, 1944, pp. xiii-274 with 32 plates, 16s. net).

THIS is a very important book and should be in the hands of all forestry and agricultural teaching institutions as well as the office libraries of all those dealing with the cultivation and improvement of the land. It brings together in an accessible and very interesting form the many experiences which have built up a knowledge of good and bad uses of land. It puts forward a very strong case for rational land utilization based upon the ecologists' point of view. The ecologist studies the reactions of all the plants and animals concerned, and their combined effect upon the soil itself, starting from the basic fact that the natural plant cover provided by nature and undisturbed by man is undoubtedly the best method of protecting the soil itself from wastage by erosion.

In this respect India has exceedingly few areas in which the natural ground cover has remained undisturbed. The patterns of land use, as seen from an aeroplane, show most vividly that very little if any of India's land surface remains unaffected by man and his animals, and that the land everywhere has been exploited or misused by over-grazing as to be considered 'worn out' in the American sense of the word, meaning that it has already reached a condition far below what nature intended in terms of productivity and natural richness. On the other hand an air view shows most graphically how water-catching is one of the major operations of a cultivator; flying over eastern Madras recently I was greatly struck with the pattern of crescent-shaped low bunds which had held up shallow but continuous sheets of water on the land, so that several days after rain had ceased, 25 to 30 per cent of the total surface area of the coastal belt were still submerged, and a month later these same areas were seen to be already green with young crops. Flying over the Punjab on the other hand gives one the impression that vast areas of the plains are being rendered useless by the uncontrolled meandering of the major rivers and minor torrents which in their present uncontrolled condition carry destruction wherever they go. Such destruction is of course exaggerated by the constant attrition of over-grazing. Misuse by heavy grazing produces an impression of aridity owing to the constant destruction of all green plants. In the case of reasonably high rainfall areas, the land does have some capacity for recuperating but in the dry climate of the desert fringe which affects not only the Punjab but large parts of Sind, Rajputana and Bombay, and to a lesser extent the United Provinces and Central Provinces, the natural potential for plant growth is so low owing to recurring drought periods that much of these parts of India are steadily approaching real desert conditions with the consequent development of shifting sand and sand dunes which are the inevitable accompaniment of desiccation. The author's vivid description of the American 'dust bowl' and the chain of consequences which has led up to this economic disaster shows how man's disturbance of the delicate balance of nature's own land pattern or mosaic has brought such terrible retribution. But America is mastering her 'dust bowl' by means of widespread remedial measures, whereas in India we have hardly started.

The author quotes many examples of the increase and decrease of animal populations, showing how some epidemics such as locusts can be readily controlled if proper steps are taken, while others such as that of the rat requires much more elaborate and expensive operations. He also issues a well-timed warning against the hasty introduction of foreign plants and animals, which may eventually become a scourge. In our own local experience the role of the rat as a destroyer of contour bunds requires the attention of a trained team of observers, and a much more widespread and energetic action by the cultivator, if it is to be controlled, and much good bunding is to be saved from spoilation by field rats.

As a matter of general interest the American classification of land according to the natural uses to which it can best be put is of sufficient general interest to be worth quoting in full.

A. *Suitable for cultivation.* (Cultivation means tillage of the soil as practised with intertilled crops and in preparing land for grain).

I. Without special practices (fertilizers and simple crop rotations may be used).

II. With simple practices (such as contour cultivation, strip cropping, or simple terrace systems).

III. With complex or intensive practices (as terraces, usually a combination of practices is needed).

IV. With intensive practices and limited use (long rotations with no intertilled crops, or cultivated in small acreages).

B. *Not suitable for cultivation: suitable for permanent pasture (range) or woodland.*

V. Without special practices; land only slightly susceptible to deterioration (grazing of range to full carrying capacity; cutting of forests without special practices to protect the land).

VI. With moderate restriction in use; land moderately susceptible to deterioration (rotation grazing; logging with careful location of trails and other practices to protect soil).

VII. With severe restriction in use; land highly susceptible to deterioration (on range only occasional grazing; in forests only highly selective logging).

C. *Not suitable for cultivation, pasture or woodland: suitable for wildlife.*

VIII. With or without special practices (productive of useful wild plants, furbearers, game birds, fish and generally serves as wild animal range).

The above classification shows how completely the American land development is being guided by the basic question of whether any given plot is inherently suitable for cultivation or not. In view of the conclusions quoted by the author which indicate that six to eight acres of land are necessary to provide food and raw material per head of population, we should realize that the corresponding figure for India is actually very much lower than that, hence the greater need for intelligent land use development. With our human population increasing and land hunger a common feature, it is astonishing to realize that many of our problems in arid land such as the immense areas of deeply ravined country, are directly due to too little use rather than too full use of that land in the past. Linked with this is another rather astonishing figure for the number of days a year in which a cultivator is fully employed on his land; in the case of the Jat of the eastern Punjab the figure is 237 days, while in the arid western district of Attock it is only 43. With the help of other land use experts the ecologist can help us to provide a more rational employment for the latter.

It is satisfactory to have confirmation from such an authority as the author of the correctness of the main features of soil conservation work in India, as already demonstrated in the Punjab and Bombay soil conservation programmes. The dividends which these programmes have already given us can be seen in the greatly improved prosperity of Hoshiarpur district, where it can truthfully be claimed that the natural principles of land use have already been applied in reclothing the Siwaliks and bringing prosperity to the communities below the hills. Such dividends are also becoming apparent in the Bombay 'scarcity areas' where emphasis has been placed upon proper and complete water conservation as the basis for future prosperity.—R.M.G.

SILK INDUSTRY—SCOPE FOR FURTHER DEVELOPMENT IN INDIA EXAMINED

Edited by E. V. S. Maniam, M.A., D.Econ. (Published by Bureau of Economic Research, P.O. Box No. 45, Cawnpore, pp. 28).

THE brochure is a compilation work as most of the information has been collected from different books. The author has quoted passages from *Economics of Sericulture* by Rawley, *Silk Industry of Japan* by Ghosh, Indian Tariff Board, etc. Though sericulture is a highly technical and intricate subject and demands expert knowledge to write up a book on it, the author in this booklet has been able to make a survey of the silk industry as at present adopted in different provinces and States. He has dealt with the subject in all its aspects such as mulberry cultivation, rearing of different varieties of univoltine, bivoltine, and multivoltine silkworms, different methods of seed production and reeling, utilization of waste silk, bleaching and dyeing of raw silk with natural and synthetic dyes and weaving. His views, if carried out properly, will be of great help for the expansion of silk industry which has vast possibilities in this country owing to the favourable climatic and other factors particularly suited for an agricultural country like India.

The general public are mostly acquainted with the finished products and are more or less ignorant of the different scientific phases of the industry. They will no doubt gather some useful information compiled in this booklet relating to silk industry in India. The publication has come out before the sericulturists at a time when it should be most needed and appreciated.

I have to mention, however, that there are some printing mistakes and inaccurate data. For example in page 17 the author says that in case of Kashmir Baghdad White variety the number of cocoons required to weigh 1 lb. is 838 which is absurd as these cocoons (i.e. 838 in number) are likely to weigh about 4 lb.

Also the author's remark in line 30, page 14 'The improved varieties Nismo and Nistid have been obtained from the result of hybridization carried out in Eastern Bengal and Burma'—is dubious and unfounded as it is open to challenge whether the said hybridization was ever carried out in Eastern Bengal. I do not now propose to point out and go into details of all other printing mistakes and inaccurate data. I do, however, feel that before this pamphlet had been finally released before the public, it should have been carefully gone through so that all the existing errors were rectified.—D.P.R.

LAND MANAGEMENT IN THE UNITED PROVINCES

By M. D. Chaturvedi (Printed by the Superintendent, Printing and Stationery, U. P., Allahabad, 1946, pp. 132).

The author of this publication, who is a senior member of the Indian Forest Service, and has also experience of village problems as Provincial Rural Development Officer, was appointed to survey existing waste-lands in the United Provinces, and to explore possibilities of their utilization along the lines suggested by Sir Herbert Howard in his 'Post-War Forest Policy in India'. The report contains a number of valuable observations and practical suggestions. After analyzing the available data, the author suggests that there are limited possibilities of extension of agriculculture in the sub-Himalayan zones of Bhabbar and Terai to the extent of 100,000 acres, provided anti-malarial measures are adopted and drainage is improved. As regards the Gangetic basin, where 70 per cent of the area is already under cultivation, he is of opinion that there are little possibilities of extension of agriculture. He is further of opinion that the direction in which improvement is to be looked for is intensive cultivation of land already under the plough. Fuel plantations for villages are recommended, which will divert cattle dung manure from the *chulah* to the fields, and will account for 15 per cent increase in production. Bunding and terracing are recommended for certain areas in the Central Indian Plateau of the United Provinces. Plantation of camping grounds, compounds of public buildings, canal and P.W.D. roads, railway lands and village waste-lands with fruit and timber trees is recommended. A review of the existing classifications of lands is also suggested. The most important suggestion which the author has made is regarding the coordination of existing development departments, through a Provincial Development Officer at the provincial headquarters and a District Development Officer at the district headquarters. This suggestion, if implemented and taken along with the building of a *panchayat* organization, from the village upwards, is likely to stimulate the villager into action. Not mere passive cooperation, but active participation of the villager in any development work, which the Government undertakes, is essential. This can only be achieved by building a bureaucratic agency to assist the cultivator, who will be learning new responsibilities under the democratic *panchayat* system. The author is to be congratulated for the excellent manner he has handled the subject and the valuable suggestions of practical nature, which he has made.—M.S.R.

From All Quarters

I. A. R. I. DIPLOMA

THE following students of the Imperial Agricultural Research Institute, New Delhi, have been awarded the Diploma of the Institute (Assoc. I.A.R.I.) after completion in September 1945 of their two-year Post-Graduate course and the acceptance by the Institute Council of the theses submitted by them as mentioned against each.

AGRICULTURAL BOTANY AND PLANT BREEDING

Prem Shanker Parsai, B.Sc. (Agri.) (Nagpur): Part I—Self and cross-incompatibility in diploid and induced tetraploid toria (*Brassica Campestris* L. Var. Toria) with special reference to pollen tube growth and seed setting.

Part II—The whole-mount method for the study of embryogeny of *Sesamum Orientale* L.

Part III—Megasporogenesis, Megagametogenesis, Endosperm and Embryo development in *Sesamum Orientale* L. and some observations on crossability between diploid and tetraploid Races of *Sesamum Orientale* L.

Malik Hukum Chand, B.Sc. (Agri:) (Punjab): Influence of the environment on yield and variation in plant character in wheat.

Mohd. Jamil Khan, M.Sc. (Aligarh): Comparative study of the morphology and anatomy of sesamum species, an auto-tetraploid and an amphi-diploid.

AGRICULTURAL CHEMISTRY AND SOIL SCIENCE

B. R. N. Iyengar, B.Sc. (Mysore), B.Sc. (Agri.) (Poona): Study of the soil fertility status as reflected by crop yields in the direct and indirect manuring of wheat.

J. K. Jagtiani, B.Sc. (Agri.) (Poona): The effect of fertilizers on soil fertility, yield, composition and quality of crop.

MYCOLOGY AND PLANT PATHOLOGY

M. S. Pavgi, M.Sc. (Benares): Part I—A third contribution towards the knowledge of Indian Ustilaginales.

Part II—Preliminary observations on some viruses causing diseases in cucurbits.

G.C. Dacosta, B.Sc. (Agri.): Part I—The genus phyllosticta in India.

Part II—A study in yeasts.

K. R. Chowdhury, B.Sc. (Calcutta): Part I—Nature of resistance to Loose Smut in some wheat varieties.

Part II—The genus Uromyces in India.

SUGARCANE BREEDING

Ghulam Yazdani, B.Sc. (Agri.): Part I—Sugarcane breeding at Coimbatore.

Part II—The relationship of certain morphological characters to lodging in sugarcane.

Jagannath Hota, B.Sc. (Agri.) (Nagpur): Part I—Studies in pith and cavity of sugarcane with a brief reference to those in some important allied genera.

Part II—Sugarcane breeding at Coimbatore.

—I.A.R.I.

BOTANICAL RESEARCH AT KEW

THE foremost service of Kew to the Empire is to provide for the identification of plants or plant products. Towards this service Kew has provided a number of classical works dealing with various regions, of which the Flora of British India, the Flora of Australiensis, both of seven volumes each, the Flora of Tropical Africa in eight volumes and the recently published Flora of West Tropical Africa are but a few. In addition to these and other regional works, Kew is responsible for the Index Kewensis, an indispensable aid in the identification of flowering plants. Live specimens and seeds are sent to Kew from all parts of the Empire and are redistributed from there. Kew's contribution to the establishment of plantation of rubber and cinchona in various parts of the Empire is well-known; but the history of the introduction of other economic plants to new areas may not be so generally realized.

Sir Geoffrey Evans, Kew's Economic Botanist, conceived the idea of removing the rose ends of potatoes and partially drying them to serve as sets instead of cutting large potatoes into smaller parts. Thus much of the crop can be used as food and still provide material for planting. These sets weigh less than one-fifth of those normally employed and thus permit of carriage by air, the method having been successful in the transport of potato sets to

Malta and other Mediterranean countries.

An entry in the Kew records, dated August 1864, shows a consignment of cocoa pods to West Africa, probably the first introduction of that plant to West Africa, and 11 varieties of West Indian cocoa were sent to Ceylon where they grew and fruited well. Ceylon now grows some of the world's best cocoa.

'Kew pine-apple,' the smooth cayenne now widely grown throughout the tropics, was imported from Kew as was Macadamia or Queensland nut. Research workers have been able to produce and export high quality and disease-resistant bananas, cassavas and passion fruit.

Wartime needs stimulated search for sources rich in vitamin, and rose hops from hedgerows of Britain were investigated and as a result a syrup was produced with about five times the vitamin content of orange juice.

Work is being carried out at Kew on the production of rubber from dandelions.—*Press Information Bureau*, February 25, 1946.

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